

QK  
495  
R2  
F84

LIBRARY  
ANNEX

2

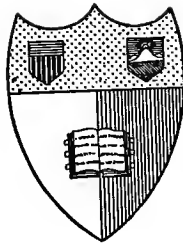
STUDIES ON THE GENUS AQUILEGIA

BY

ALLAN CAMERON FRASER

---

1918



New York  
State College of Agriculture  
At Cornell University  
Ithaca, N. Y.

---

Library

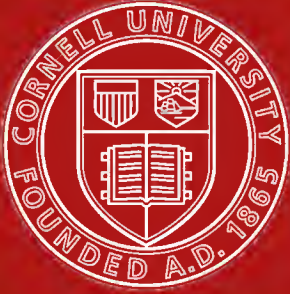
Cornell University Library  
**QK 495.R2F84**

**Studies on the genus *Aquilegia*.**



3 1924 001 708 183

mann



Cornell University  
Library

The original of this book is in  
the Cornell University Library.

There are no known copyright restrictions in  
the United States on the use of the text.

<http://www.archive.org/details/cu31924001708183>

**Studies on the Genus Aquilegia**

**by**

**Allan Cameron Fraser**

**1918**



### Acknowledgment

The writer wishes to express his grateful appreciation to Professor A. C. Beal of the Department of Floriculture and to Professor W. W. Rowlee of the Department of Arts Botany for assistance rendered him in the course of these studies. Professor Beal offered helpful criticisms and suggestions through the course of the work and placed at the disposal of the writer, all of the land necessary for the growing of the *Aquilegia* plants. Professor Rowlee also made a number of helpful suggestions and aided further by supplying herbarium material of native and foreign species.



## Studies on the genus *Aquilegia*

The genus *Aquilegia* contains many interesting and valuable species of plants. The taxonomic botanist finds interesting problems in the classification of its many types. The horticulturist draws from it a wealth of material for his border plantings and his rock gardens, and encounters many problems in adaptation and culture. And the plant breeder finds a large number of genetic characters on which to study inheritance.

Up to the present time a certain amount of work has been done on the genus, but the subject has never been exhausted in any of its phases. Furthermore, the literature on *Aquilegia* is scattered and no attempt has been made to review it in one paper.

The studies herewith presented are not to be accepted as complete in every detail. The genus is too large and its members too scattered to permit of an exhaustive study within a limited space of time. An attempt has been made, however, to present such information as could be gathered from the literature, and to verify it and supplement it as much as possible by studies on the living plants.

### Purpose of this study

The attention of the writer was drawn to the genus *Aquilegia* in the spring of 1913, when he was working at the New York Botanic Garden. The large collection of growing



plants and the unusually good herbarium at the Botanic Garden suggested a taxonomic study of the genus. A number of crosses were made between the most striking types, and plants of each species were bagged for pure seed. At the present time the studies are not completed. It will take some years of investigation before a number of the minor problems which have arisen will be settled. This report is fairly complete, however, as far as it attempts to go.

The purpose of these studies has been several-fold. In the first place it was intended that a complete collection of species descriptions should be made and that so far as possible the validity of the various species should be determined. There would naturally follow the working out of the synonymy of *Aquilegia* and the construction of a key for the identification of unknown species. Notes upon the culture of the different species and upon the horticultural uses of the columbines have also been added.

#### Methods of study

Wherever it was possible, the studies of the species were made upon the living plants. Such observations could be made, of course, on all of the species and varieties of horticultural importance. There were many rare species, however, whose seed could not be obtained. In such cases the published descriptions had to be used entirely. In still other cases no information other than the name of the species could be



obtained. Herbarium specimens were studied, when they could be obtained. The collections at the New York Botanic Garden and at Cornell University were found very helpful. In the case of each species an effort was made to get all the information possible, first by studying the growing plants, then by examining herbarium specimens, and thirdly by looking over published accounts of the species.

### The Family Ranunculaceae

The genus *Aquilegia* belongs to the family Ranunculaceae of the order Ranales. Wiegand\* has given the following description of this family.

"Ranunculaceae - Flowers spirally constructed, except often the perianth, regular or irregular; sepals 3 to many, usually 5, separate, often petaloid; petals 3 to many or 0, often in the form of honey glands; stamens usually very numerous, hypogynous; carpels 1 to many, usually separate; fruit an achene or follicle, rarely a capsule or berry; seeds with endosperm."

There are about 27 genera in the family and about 680 species, most of which are found in the north temperate and sub-arctic regions. Clematis, Anemone and Delphinium cross the equator at the south. Ranunculus is the largest genus. The family Ranunculaceae is related to Magnoliaceae, Annonaceae, .

---

\*Wiegand, K. C. - A synopsis of the plant kingdom.  
In Bailey's Enc. Hort. Vol. 1, p. 32



Dileniaceae, Nymphaeaceae, and other families with acyclic flowers and numerous carpels.

The spiral floral structure, numerous hypogynous stamens, and the usually separate carpels are the most distinctive characteristics of the family. The family Ranunculaceae is probably an old one. It is thought by some to be the closest to the stock from which the dicotyledons have sprung.

Within the different genera of the family, the flower structure is quite variable. The petals, when present, are rarely normal. In *Aconitum*, *Delphinium* and *Aquilegia* the petals are spurred and nectar-bearing. *Thalictrum* is wind-pollinated.

Prantl makes 3 tribes of the family:

Tribe 1 - Fruit follicular, carpels fleshy, outer seed-coat long, eg. *Paeonia* and *Hydrastis*.

Tribe 2 - Fruit usually follicular, carpels rarely fleshy, outer seed-coat not larger than inner, eg. *Caltha*, *Helleborus*, *Coptis*, *Actaea*, *Aquilegia*, *Delphinium*, etc.

Tribe 3 - Fruit an achene, eg. *Anemone*, *Clematis*, *Ranunculus*, *Thalictrum*, etc.

There are many useful plants in this series, most of them ornamentals, and a number drug plants. Among the general which have cultivated forms are: -



|                    |                   |
|--------------------|-------------------|
| Aconitum-----      | monkshood         |
| Actaea-----        | baneberry         |
| Adonis-----        | adonis            |
| Anemone-----       | windflower        |
| Aquilegia-----     | columbine         |
| Caltha-----        | marsh marigold    |
| Clematis-----      | Virgin's bower    |
| Coptis-----        | gold thread       |
| Delphinium-----    | larkspur          |
| Eranthis-----      | winter aconite    |
| Helleborus-----    | Christmas rose    |
| Hydrastis-----     | golden seal       |
| Nigella-----       | love-in-a-mist    |
| Paeonia-----       | peony             |
| Ranunculus-----    | buttercup         |
| Thalictrum-----    | meadow rue        |
| Trautvetteria----- | false bugbane     |
| Trollius-----      | globe flower      |
| Xanthorrhiza-----  | shrub yellow root |

\* Note

The genus Aquilegia

Tournefort - (1719) is given credit for the first comprehensive description of the genus Aquilegia. Prior to the publication of his Institutiones rei herbariae, in

---

\* Family description from Wiegand, K. C.  
loc. cit.



which this description appeared, Dodeens (1619), Gerarde (1633), Bauhin (1651), and others had published fragmentary descriptions of the genus and of such types as were known to them. Tournefort's characterization of the genus is by no means as complete as many published after his time, but it is remarkably accurate and scientific for a brief description. Plate I is a photograph of Tab. 248, from Tournefort's books. The species shown is undoubtedly *vulgaris*, a spurless double type of which appears at M. It will be noted that Tournefort has shown six follicles instead of five, in the fruit. This variation in number quite frequently occurs, although six is not the typical number for the genus. Aside from this minor defect, the plate serves admirably to illustrate the essential characteristics of the genus.

One of the most complete descriptions of *Aquilegia* is that published by Asa Gray in his Genera of the plants of the United States (1849). This description follows:

"Calyx petaloid, regular, imbricated in aestivation; sepals 5, spreading, ovate or oblong, deciduous. Petals 5, all similar in size and shape, hypogynous, inserted by the inner margin or lip of the oblique expanded limb, alternate with the sepals, and produced backwards between them into a long infundibuliform-tubular spur. Stamens indefinite, hypogynous, obscurely collected into 5-10 clusters, filaments filiform and elongated; some of the innermost abortive, desti-



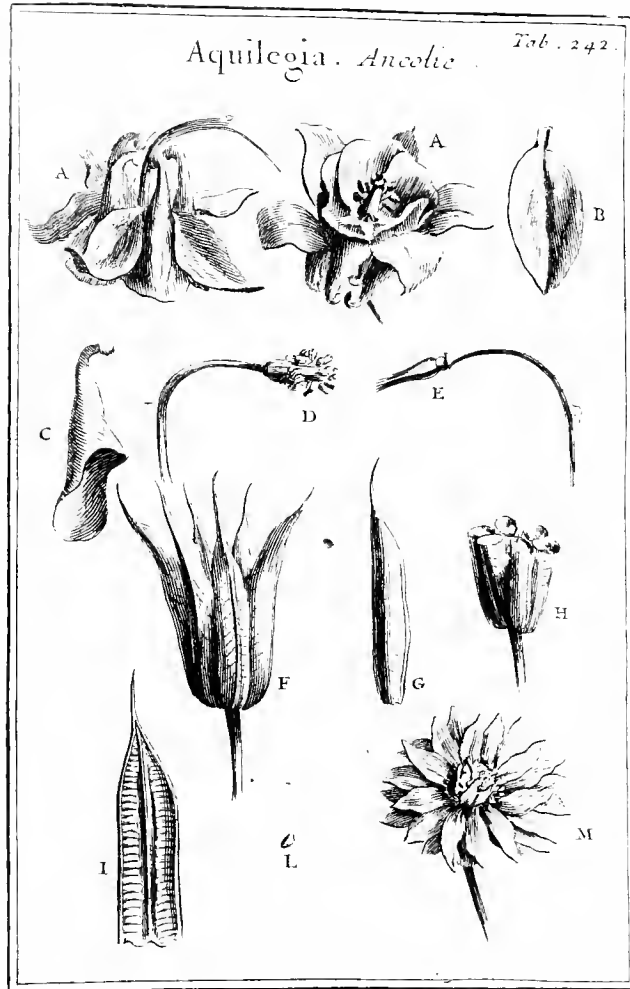


Plate 1 - Showing the parts of the columbine flower and fruit. From Tournefort, -  
Institutiones rei herbariae, - 1719.



tute of anthers, and converted into membranaceous scales which collectively surround the ovaries; anthers oval, innate, the cells opening lengthwise laterally. Pistils usually fine, sessile, erect or oppressed; ovary cylindraceous, one-celled, many ovuled; style filiform, elongated, stigma unilateral at the apex. Ovules indefinite, occupying the whole length of the ventral suture in two series, horizontal, anatropous, the raphes collateral.

"Follicles usually 5, sessile, erect and oppressed, nearly cylindrical, veiny, tipped with the slender persistent styles, dehiscent through the ventral suture from the apex downward. Seeds numerous, in two series, horizontal, small, oval, smooth and shining; the crustaceous testa conformed to the nucleus. Embryo minute, at the base of the corneous-fleshy albumen, cordate; the radicle next the hilum.

"Herbs, with erect and usually paniculate-branching stems, from thickened and fibrose perennial roots; the alternate leaves bi-tritermately compound; and the large and showy flowers singly terminating the stem and branches. Lower leaves long-petioled; the uppermost subsessile, or reduced to bracts. Petioles more or less dilated at the base. Leaflets roundish, incisely lobed, glaucous underneath."

The flower parts in *Aquilegia* are all cyclic. In this respect it represents an advance over the genus *Ranunculus*, where the stamens and carpels have a spiral arrangement. The



parts of the perianth are free, and the gynoecium is apocarpous. The floral formula for the genus is:  $K-5; C-5; A-5 \times (8-12), G-5$ . The following flower-diagram from Goebel (1887), shows the arrangement of parts in *Aquilegia*.



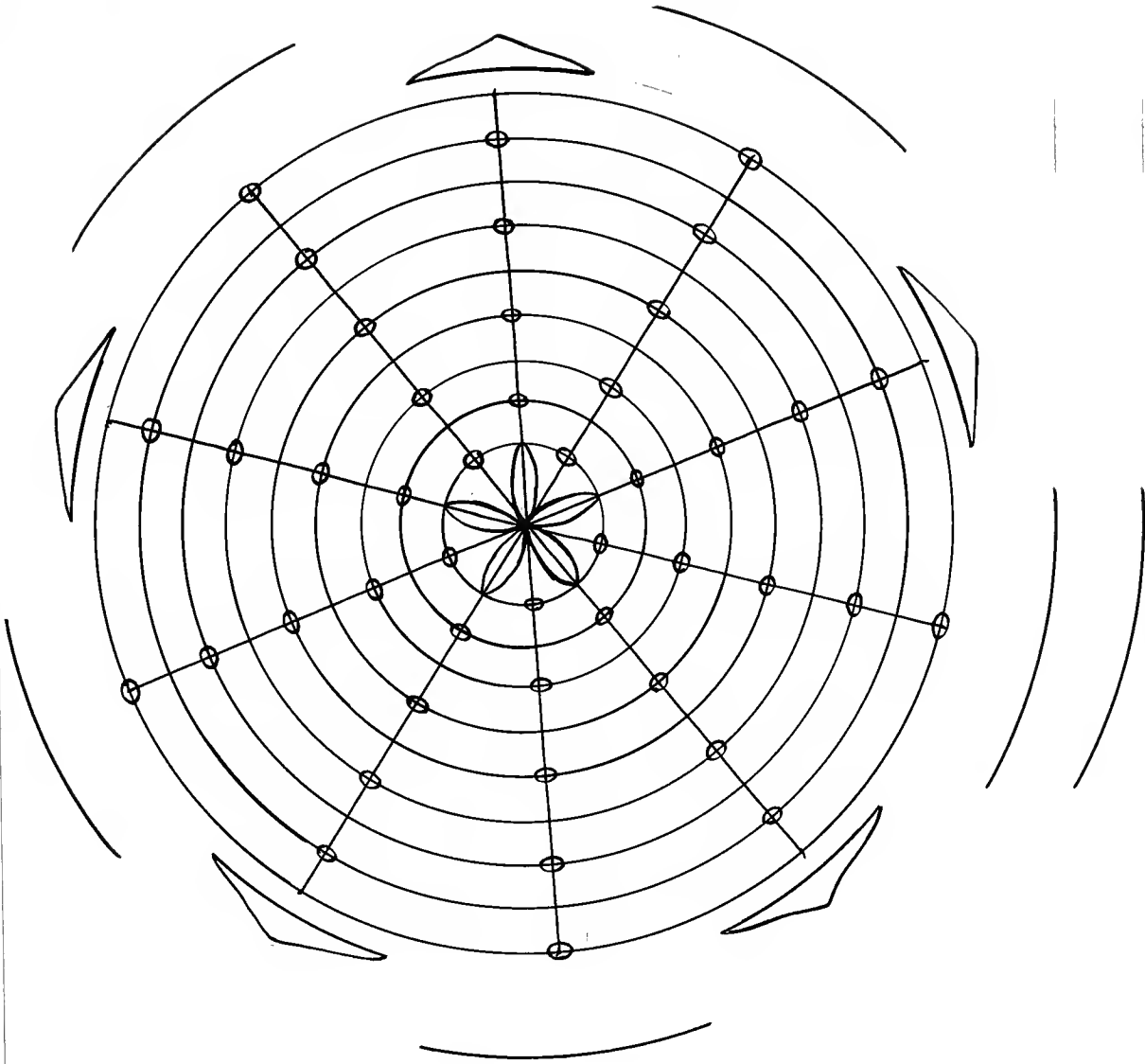


Fig. 1. — Floral diagram of *Aquilegia*.



### The name Aquilegia

There seems to be a little doubt as to the derivation of the word Aquilegia. Some writers believe it to have come from Aquila, meaning eagle, from the fancied resemblance of the spurs to the beak and talons of an eagle. Still others maintain that it comes from aqua - water, and legio - to draw, from the supposed great needs of the plant for water. The latter explanation sounds more probable. The common name, columbine, is generally agreed to come from the resemblance of the spurs to beaks of doves, or even to the whole bird. It comes from the Latin, columba - a dove.

### The species of Aquilegia

When one attempts to list the species of Aquilegia of recognized standing, one is confronted with a number of difficulties. Aquilegia, like many other genera, contains a number of species of doubtful validity. It is very hard to decide which species should be included and which omitted from the list. Those species which are commonly used in horticulture are well established and present no difficulties. There are many types from India and the Himalayas, however, and local forms from central Europe and from this country which cannot be as readily accepted.

If it were possible to get self-fertilized seed of all the doubtful types and to raise plants of each, it would be a comparatively easy matter to pick out the dis-



inct types. The change in environmental conditions would undoubtedly bring about changes in the appearance of the plant, but hardly changes so great as to cause a blending of types.

In these studies an effort was made to obtain seed of all the different species of *Aquilegia*. Seedsmen in this country and in Europe were able to supply seed of the commonly grown types. The Royal Horticultural Society of England furnished a mixed sample of seed, saying that it was all they could send, as the war had necessitated giving up most of their gardens. Many interesting types were obtained from this lot of seed, but the plants were hardly useful as a basis for accurate description and classification. Between 60 and 80 packets of seed, representing almost as many named types, were obtained through the Bureau of Plant and Seed Introduction at Washington, by the courtesy of Mr. Dorsett and Mr. Bissett. These seeds were sent from botanic gardens at Madrid, Spain; St. Petersburg, Russia; Geneva, Switzerland; Dublin, Ireland; Edinburgh, Scotland; and Stockholm, Sweden; as well as from seed houses of various countries. Many of the plants from these seeds bred true to type and were described. A large number, however, had been open-pollinated and the resulting hybrids came far from agreeing with the descriptions of the species which they were supposed to represent. An appeal for seed was also made to botanists



and experiment station workers in the western part of this country. It was hoped in this way to get seed of the rarer species. Only the seed of the commoner sorts could be supplied, however. The botanists who had described certain of the rarer species in this country, wrote that it would be impossible to obtain seed of these except by sending a collector to the isolated canons or mountain sides where they grow.

Thus while many of the species descriptions were taken from the living plants, as well as from the literature, a large number had to stand exactly as they came from botanical publications. Regarding other species little could be learned except the name. These were described in Hungarian and Russian periodicals which are not accessible in this country.

The question which naturally arises in connection with the less common forms is this: - Are these types distinct botanical species, or are they merely races or perhaps local variations of well recognized species? Undoubtedly some of the named species are of the latter types.

Another question which may well be asked regarding any species of uncertain rank is this: - Has this species been described before under another name, and if so, which name has the priority? In other words, we are confronted with certain problems in synonymy. There is hardly a type of columbine which has not been described under several species names.



In the case of *Aquilegia vulgaris*, at least 40 other specific names have been applied. (Index Kewensis).

It is quite evident that any list of species of *Aquilegia* is likely to be incomplete in some respects, and also is likely to contain the names of some species of doubtful rank. Britton (Illus. Fl. Vol. 3, p. 92) places the number of species of columbines at about fifty. The Index Kewensis lists over ninety species, exclusive of synonyms. Over one hundred botanical types have been described.

The following list of species, which has been compiled after a careful study of the available literature, is felt to be reasonably complete and accurate.

#### Species of *Aquilegia*

- \**A. alpina*, Linn.
- A. baikalensis*, Hort.
- A. bertoloni*, Schott.
- A. brevistyla*, Hook.
- \**A. buergeriana*, Sibb. and Zucc.
- \**A. caerulea*, James.
- \**A. canadensis*, Linn.
- \**A. chrysantha*, Gray.
- A. coccinea*, Small.
- A. columbiana*, Rydb.
- A. ecalcarata*, Eastwood.
- A. einseleana*, Fr. Schultz.
- A. elegantula*, Greene.
- \**A. flabellata*, Sieb. and Zucc.
- A. flavescens*, B. Wats.
- \**A. formosa*, Fisch.
- A. fragrans*, Benth.
- \**A. glandulosa*, Fisch.
- A. glauca*, Lindl.
- A. haylodgensis*, Hort.
- \**A. helenae*, Hort.
- A. Jonesii*, Parry
- A. kitaibelii*, Schott.



- A. *lactiflora*, Kar. and Kir.
- A. *laramiensis*, Nelson.
- A. *leptoceras*, Fisch. and Mey.
- A. *longissima*, Gray.
- A. *Madrensis*, Rose.
- A. *micrantha*, Eastwood.
- A. *moorcroftiana*, Wall.
- A. *oreophila*, Rydb.
- \*A. *oxysepala*, Trautv. and Mey.
- A. *parviflora*, Ledeb.
- A. *pubescens*, Coville.
- A. *pubiflora*, Wall.
- \*A. *pyrenaica*, D. C.
- A. *saximontana*, Rydb.
- \*A. *sibirica*, Lam.
- \*A. *Skinneri*, Hook.
- A. *Stuarti*, Hook.
- \*A. *truncata*, Fisch. and Mey.
- \*A. *viridiflora*, Pallas.
- \*A. *vulgaris*, Linn.

Note: - The better known species are marked with \*  
 A number of Indian and Hungarian species have been omitted from this list, because of a lack of information regarding them.



K E Y S



### Aquilegia Keys

One of the first keys to the genus *Aquilegia* was prepared by J. G. Baker and published in The Gardeners' Chronicle, 1878, p. 203. This key is of interest because it shows certain group relationships between species. As an aid in identifying unknown species of columbines, however, it fails to serve its purpose. The headings for certain groups are altogether too general, and no clear distinctions are made between the members of any group.

"Systematic Key to the Known Species of *Aquilegia*" - - Baker.

Group 1 - *Micranthae* - Small flowered columbines.

Stem leaves all small and bract-like.

*A. einseleana*, *A. viscosa*  
*A. thalictrifolia*, *A. parviflora*.

Lower stem leaves large petioled and biternate.

Lamina of petals much shorter than sepals.

*A. lactiflora*, *A. pubiflora*.

Lamina of petals nearly or quite as long as sepals.

Spur short and curved.

*A. brevistyla*.

Spur moderately long and nearly straight.

*A. viridiflora*, *A. buergeriana*.  
*A. canadensis*, *A. flavescens*.

Group 2 - *Mesanthae* - Middle sized flowered columbines.

Stem leaves all small and bract-like.



*A. pyrenaica*, *A. bertoloni*.

Lower stem leaves large petioled and biternate.

Spur short

*A. glauca*, *A. flabellata*.

Spur about as long as the lamina of the petal.

Lilac-claret-white flowers; short stamens.

*A. moercroftiana*, *A. amaliae*

*A. leptoceras*, *A. vulgaris*

*A. Siberica*

Red yellow flowers; long stamens.

*A. formosa*, *A. Skinneri*

Spur very long.

*A. chrysantha*.

Group 3 - *Macranthae* - Large flowered columbines.

Spur short - *A. glandulosa*.

Spur moderately long - *A. alpina*, *A. fragrans*.

Spur very long - *A. caerulea*.

Rydberg, (1905), presents a key for the determination of the Colorado species. This key is good as far as it goes, but it only includes seven species.

Coulter and Nelson, (p. 191), give a key to the Rocky Mountain species, nine in all. This key appears to be fairly complete for the territory which it covers. It is also easy to follow.



Coulter and Nelson's Key to Rocky Mountain Columbines

Spur longer than the calyx.

Flowers red in whole or in part-----1. *A. elegantula*

Flowers never red.

Flowers blue or white -----2. *A. caerulea*.

Flowers yellow or bluish -

Spurs long (5-7 cm.) yellow-----3. *A. chrysantha*.

Spurs shorter (4 cm, or less)  
bluish-----4. *A. oreophila*.

Spurs shorter than the calyx.

Stem leafy or not wholly naked-scapose; flowers several.

Flowers yellow or yellowish.

Plant tall (more than 2 dm.)

Spur as long as lamina-----5. *A. flavescens*.

Spur nearly wanting-----6. *A. Eastwoodiae*.

Plant lower (less than 2 dm. high)  
7. *A. laramiensis*.

Flowers blue-----8. *A. saximontana*

Stems scapose-----9. *A. Jonesii*.

The most inclusive key to the *Aquilegias* which has been prepared thus far is one which was compiled from the partial key and the descriptions by Davis, K. C. - In Bailey's *Cyclopedia of Horticulture*. This key has the advantage of dealing almost entirely with the flower parts and not with the less definite leaf and plant characters.



- A. - Sepals not more than  $1/2 - 3/4$  in. long; expanded flowers  
1 -  $1-1/2$  in. diam.
- B. - Limb of petals shorter than sepal.
- C. - Stem very short.
  - D. - Follicles glabrous - *A. Jonesii*.
- CC. - Stem over 1' high.
  - D.- Spur knobbed and bent. - *A. oxysepala*.
  - DD.- Spur not knobbed and nearly straight.  
*A. lactiflora*.
- BB. - Limb of petal about equal to sepal.
  - C. - Spur straight or nearly so.
    - D. - Spur  $1/2$ " long. Stamens protruding beyond  
the petal-limb - *A. viridiflora*.
    - DD.- Spur  $3/4$ " long.
      - E. Stamens equal to petal-limb -  
*A. buergeriana*.
    - EE. - Stamens much protruding -  
*A. canadensis*
- AA. - Sepals about 1" long; expanded flower about 2" diam.
  - B. - Spurs shorter than petal-limb and incurved -  
*A. flabellata*.
  - BB.- Spurs at least as long as the petal-limb.
    - C. - Stamens short; not much protruding.
      - D. - Spurs slender and only slightly curved -  
*A. leptoceras*.
      - DD.- Spur stout and much curved.
        - E. - Follicles densely pubescent -  
*A. vulgaris*.



EE. - Follicles glabrous.

Flowers pale or bright lilac-blue -

*A. sibirica*.

CC. - Stamens long, protruding far beyond the petal-limb.

D. - Spurs spreading somewhat - *A. formosa*.

DD.- Spurs not spreading - *A. Skinneri*.

BBB. - Spurs very long, several times the length of the petal-limb.

C. - Orifice of the spur not much contracted;  
early flowering - *A. chrysantha*.

CC.- Orifice of the spur contracted; late flowering  
*A. longissima*.

AAA. - Sepals 1-1/4 - 1-1/2 or even 2" long; expanded flower  
2-1/2 - 3" in diameter; stamens not protruding.

B. - Spurs long and not incurved - *A. caerulea*.

BB. -Spure incurved and only a little longer than  
the petal-limb.

C. - Plant not over 1' - *A. alpina*.

CC.- Plant 1-1/2' or thereabouts -  
*A. glandulosa*.

The following key has been prepared by the writer from a study of the living plants, where possible, and also with the aid of herbarium material and published descriptions. An effort has been made to confine the attention to the characteristics of the flower parts, since these are usually the most constant and most sharply defined parts of the plant. Fruit and leaf characters as well as stature have been brought



into the key where it was felt that a sharper distinction could be made between species on the basis of these parts. This key may be found useful when applied to fairly typical plants of any given species. Allowance has been made for a certain amount of variation in the plant parts, but it is quite probable that widely divergent individuals may be found which fail to come within the range allowed.

It must be remembered that nearly all of the species of *Aquilegia* will cross-fertilize readily, producing in a natural state a great variety of hybrid forms. Probably most of the garden columbines are not good types of certain species, but rather hybrid plants produced either by artificial or natural crossing. Where these plants show the characters of one parent in a dominant condition, it may be possible to trace this parent by means of the key. Complete dominance of characters seems to be the exception, rather than the rule, in plant crosses. Hybrid forms, therefore, would be likely to appear more or less intermediate between the parents. It is obvious that an attempt to identify such plants would in most cases lead to naught.

Before attempting to identify a plant with a key, one should ascertain if possible whether it is a native species or one from central Europe, India, or Asia, or whether it came from a collection of cultivated plants. If it is a wild species and its approximate range is known, maps show-



ing species from the different parts of the world will serve as a guide in the use of the key. If it is known to be from a bed of cultivated plants, one should consult the list of *Aquilegias* most commonly offered by the seedsmen.

The first division in the key is made on the basis of color. There are two well marked groups of columbines with respect to color: those with red, yellow, or green flowers, including the scarlets and yellows, brick reds and yellows, and the greenish yellows; and those with blue, maroon, pink, purple, lilac and white. The first group includes *A. canadensis*, *A. chrysantha* and *A. viridiflora*. The second group takes in *A. vulgaris*, *A. alpina* and other plants containing blue, purple-reds and blue-reds, and whites.



Key to the species of Aquilegia



A. Red-yellow-green group.

B. Spurs averaging more than 2 cm. in length.

C. Stamens much exerted beyond petal lamina.

D. Fruit smooth; sepals averaging less than 2 cm. in length.

A. canadensis.

DD. Fruit winged, at least when young; sepals averaging over 2 cm. in length.

A. Skinneri.

CC. Stamens not far exerted beyond petal lamina.

D. Spur longer than 8 cm; spur orifice narrow.

A. longissima.

DD. Spur shorter than 6 cm. on average.

E. Foliage pubescent, at least below, and parts of inflorescence pubescent.

F. Sepals averaging less than 1.8 cm. in length; follicles nerved.

A. madrensis.

FF. Sepals averaging over 2 cm. in length. Spur incurved.

A. pubescens.

EE. Foliage smooth on both surfaces.

A. Chrysantha.

BB. Spurs less than 2 cm. long.

C. Stamens much exerted beyond petal lamina.

D. Follicles pubescent; sepals less than 1.5 cm. long.

A. micrantha.



DD. Follicles glabrous; sepals over 1.8 cm. long.

E. Lamina not truncate.

A. formosa.

EE. Lamina very short and truncate.

A. truncata.

CC. Stamens not far exerted beyond lamina of petal.

D. Spur much incurved; inflorescence puberulent.

A. laramiensis.

DD. Spur straight or nearly so.

E. Spur at least as long as sepal, generally longer.

F. Stems finely pubescent above.

G. Flowers yellow, tinted with claret purple; petal-limb 1.3 to 1.6 cm. long.

A. buergeriana.

GG. Flower yellow, sometimes tinted with red. Petal-limb .8 to 1.3 cm.

A. flavescens.

FF. Stems glabrous throughout.

A. elegantula.

EE. Spur averaging shorter than sepal.

A. viridiflora.



AA. Blue-white group (Pink, lilac, lavender, etc.)

B. Spurs straight or nearly so.

C. Sepals 2.5 cm. or over.

D. Spur longer than sepals.

E. Follicles pubescent.

A. caerulea.

EE. Follicles glabrous.

F. Flower parts colored.

A. haylodgensis.

FF. Flower parts nearly all white.

A. chrysantha var. alba.

DD. Spur shorter than sepals.

E. Follicles pubescent.

F. Flowers fragrant.

A. fragrans.

FF. Flowers not particularly fragrant.

A. glauca.

EE. Follicles glabrous.

F. Lamina over half as long as sepals.

A. Helenae.

FF. Lamina less than half sepals.

A. pyrenaica.

CC. Sepals usually less than 2 cm. long.

D. Follicles pubescent.

E. Lamina over half as long as sepal.

A. moorcroftiana.



EE. Lamina not over half as long as sepal.

A. leptoceras.

DD. Follicles glabrous.

E. Plant over 3 dm. high.

F. Flower white or very lightly tinted with blue.

A. lactiflora.

FF. Flower bluish.

A. oreophila.

EE. Plant less than 1.5 dm. high.

A. Jonesii.

BB. Spurs strongly curved or even coiled.

C. Sepals 2.5 cm. or over.

D. Follicles pubescent.

E. Lamina half as long as sepals, or more.

F. Spurs not over 1.55 cm. long; plant generally under 1 foot high.

A. alpina.

FF. Spurs over 1.5 cm. long; plant over 1 foot high.

A. vulgaris.

EE. Lamina less than half as long as sepals.

F. Spurs less than 1 cm. long.

A. glandulosa.

DD. Follicles glabrous.

E. Spur 1.25 cm. or more long.

F. Stems finely pubescent.

A. bertolani.



FF. Stems glabrous.

A. sibirica.

EE. Spur less than 1.25 cm. long.

A. flabellata.

CC. Sepals less than 2.5 cm. long.

D. Plant less than 3 dm. high.

E. Lamina of petal equal sepal in length.

A. einseleana.

EE. Lamina of petal about half as long as sepal.

F. Spur less than .32 cm. long.

A. parviflora.

FF. Spur over .6 cm. long.

A. saximontana.

DD. Plant over 3 dm. high.

E. Follicles pubescent.

F. Lamina about equal to sepal in length.

A. kitaibelii.

FF. Lamina not over 3/4 as long as sepal.

G. Flower delicate pink or white; spur small, sac-like.

A. ecalcarata.

GG. Flower bluish.

A. oxysepala.

EE. Follicles glabrous.

F. Styles short, included in column of stamens.

A. brevistyla.



FF. Styles extending beyond stamens.

G. Sepals finely pubescent.

A. pubiflora.

GG. Sepals glabrous.

A. baikalensis.



### Historical

A discussion of the species of *Aquilegia* would hardly be complete without a review of the early botanical descriptions.

As has already been said, Tournefort (1719) is credited with the first accurate description of the genus. Columbines had been described in botanical literature, however, more than one hundred years prior to that time. As early as 1526 Albrecht Dürer<sup>"</sup> figured *A. vulgaris* in the *Albertina*, Vienna, showing double and single flowers on the same plant. Fuchs in 1542, published a very general description of *Aquilegia*. L'Obel, in 1581, described double and spurless forms. Dodoens, in 1619, also published a general description of the genus. (See plate 2.) At that time the Latin name of *Aquilegia*, or *Aquileia* was used.

John Gerarde, in 1633, published at some length on the columbine, and figured eight types. (See plates 3 and 4.) He described a "blew" columbine, a purple-red one, and other types of doubles and spurless forms. These are evidently all varieties of the common European species, *A. vulgaris*, L. Gerarde's figures of columbines are very interesting. While they are perhaps not accurate in every detail, they nevertheless show that the double and spurless types of columbines originated before 1633.



## CHAP. XVI.

### Of Columbine.

#### *The Description.*

**C**olumbine hath great broad leanes, with two or thre vey cuts or gashes in the leaues, like to the leanes of the great Celondine, but whiter (and in some kinds of a darke sage colour) but of no strong sent or sauour, neither yeldeth forth any such yellow iuyce; sap, or liquo, when it is broken or brused, as the Celondine doth: the stalks be round, and plaine or smooth, of two or thre fote long, vpon which grow the floures, compact of two kinds of litle leanes, whereof one sort, are small and narrow, and the others growing with them are hollow, with a long crooked taile like Hawks-claw (and bending somewhat towards the proportion of the necke of a Culuer) The floures are sometimes single, and sometimes double, and of colour sometimes blew sometimes white, sometimes skie colour, sometimes red, sometimes speckled, and intermingled with blew and white. After the vanishing of the said floures, there commeth forth foure or five sharpe husks or cods, growing toynntly together, wherein is contained a blacke (shining) seed.

#### *The Place.*

They sow and plant them here in gardens, and they do also grow in high woods, and rocks, but not in this country.

#### *The Time.*

They floure most commonly in May and Iune.

#### *The Names.*

This floure is now called in Latine Aquilegia, or Aquileia, and of the later writers Columbina, unknowne of the Ancients; howbeit some late writers make a question, whether it be Ponthos Theophrasti, sine Desiderio, after the interpretation of Gaza: it is called in English Columbine, of the shape and proportion of the leaues of the floures which do seme to expresse the figure of a Dove, or Culuer: in French *Aucoly*: in high Dutch, *Agley*, and *Ageley*: in base Almaine, *Akeley*.

#### *The Nature.*

Columbine is temperate in heat and moisure.

#### *The Virtues.*

This floure, as Ruellius writeth, is not used in medicine: howbeit some of the new writers do affirme it to be good against the iaudise, and sounding, and it openeth the waters of the liver, and the people vse it against the inflammation and sores of the lantes and winde-pipe. These floures mingled with wheaten meale, make a good plaister against scratches and gauls.

## CHAP. XVII.

### Of Goats beard, or Iosephs floure.

#### *The Description.*

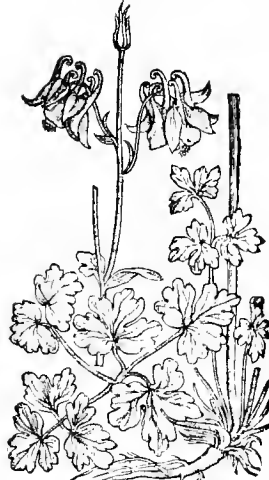
**G**oats-beard hath a round straight knotty stem, couered with long narrow leanes, almost like to Carlake leanes. At the top of the stems it beareth faire double floures, and full: of colour sometimes blewish purple, with golden threds



1. *Aquilegia vulgaris*  
The Common Columbine.



2. *Aquilegia rubra*  
Red Columbine.



3. *Aquilegia multiplex*  
Double Columbine.



4. *Aquilegia variegata*  
Variegated Columbine.





‡ 5 *Aquilegia rubra*.  
Inverted Columbine with the red flower.



‡ 6 *Aquilegia flo. inverso albo*.  
Inverted Columbine with the white flower.



‡ 7 *Aquilegia flore rosæ*.  
Rose Columbine.



‡ 8 *Aquilegia degener*.  
Degenerate Columbine.





John Parkinson, in 1640, described two new sorts of columbines. One of these was our common *A. canadensis* and the other was evidently a variegated form of *A. vulgaris*. Parkinson gave to the first the name "*Aquilegia Virginiana flore rubescente praecox* - the early red columbine of Virginia."

Bauhin, in 1651, gave a general description of the genus and described eight types. One of these, *Aquilegia montana magno flore*, is possibly our *A. alpina* of to-day.

Matthiolum, in 1674, described *Aquilina* and *Aquilina flore pleno*.

Tournefort, 1719, published a good description of the genus and in addition he described and named a large number of types, most of them undoubtedly varieties of *A. vulgaris* and some probably local variations of no taxonomic importance.

Georgius Clifford, in 1737, described seven types of columbines.

Linnaeus, in 1762, and in 1766-68, laid the foundation for our present binomial system of nomenclature and definitely named and described many genera and species. His descriptions of *A. vulgaris*, *A. alpina* and *A. canadensis* are taken as the standards for these species.

Miller, 1807, described a few species, mostly after Linnaeus, and gave some good suggestions on culture



and on the selection of types.

Pursh, 1814, described a few species.

DeCandolle, in his Flora of France adds a description of *A. pyrenaica*, an alpine form from the Pyrenees.

Torrey, Gray, Hooker, and other writers of the middle of the nineteenth century added materially to our knowledge of species. Boissier, Flora Orientalis - 1867-1884, has contributed to our knowledge of the eastern species. Vineze Borbas, writing in Hungarian periodicals, has described a number of species of columbines. Some of these species are: *A. Braunii*, *A. campylocentra*, *A. dioica*, *A. eximia*, *A. Gaertneri*, *A. Haynaldi*, *A. Hispanica*, *A. Hookeri*, *A. Huteri*, *A. lutescens*, *A. macrocentra*, *A. Molleriana*, *A. orthantha*, *A. pycnotricha*, *A. stenopetala* and *A. szaboi*. Borbas published largely in Magyar Tudom. Akad. publications from 1881 to date. Many of his species are of doubtful value.

J. G. Baker, 1878, brought our knowledge of columbines up to date in a thorough synopsis of the genus.

Since Baker's work was completed, Rydberg, Small, Nelson, Eastwood, and other botanists have added new species to the list. K. C. Davis, in Bailey's Cyclopedia of Horticulture, gives a good synopsis of the better known species. His review of the genus in Minnesota Botanical Studies, Series 2, 1899, is excellent. The Index Kewensis does much to straighten out the confusion in the nomenclature of *Aquilegia*



and to show us which names are synonyms and which to be accepted.

Note:

Unless otherwise stated, the first reference following the description of each botanical species is a reference to the original description of the species.







1. - A. alpina - Linn.

Plant less than 2 feet high; stems finely pubescent above. Root-leaves two-to-three-ternately divided, glabrous below, more membranous than in *A. vulgaris*, partial petioles of basal leaves 1-2 inches long, with 3 nearly sessile divisions; deeply lobed.

Flowers few in number, 1-1/2 to 2 inches across, blue and showy. Sepals 3.28 to 3.81 cm. long, broad ovate with acute claw, more than half as broad as long. Lamina of spurs half as long as sepals, slightly rounded and faintly emarginate at tip, often white in color especially in the variety. Spurs of same length as lamina, more or less incurved, blue, knobbed. Stamens scarcely, if any, exerted beyond petal limbs. Style 1/4 - 1/3 inch long. Follicles pubescent, 1-1-1/4 inches long.

Season - May and June.

Range - Mountains of central Europe up to 7,000 feet. From Dauphine eastward to Transylvania and Savoy. More alpine than *A. vulgaris*.

Description from living plants: Spurs Blanc's violet below claw. Dauphine's violet on lamina. Sepals almost fluorite violet, but more blue and more velvety. An average of 50 measurements gives the following dimensions for the flower parts: Spurs 1.80 cm; lamina 1.41 cm; sepals 3.00 cm x 1.42 cm.



A semi-dwarf species with lilac-blue or whitish flowers. Can be distinguished from *A. vulgaris* by its smaller stature, fewer flowers, larger size of flowers, and shorter, thicker spurs. The petals, also, are broader and more expanded<sup>than</sup> in *A. vulgaris*.

A very hardy species. One of the best for the rock garden. Not easily propagated by root division.

#### References:

- Linnaeus - 1762. Vol. 1 - p. 752  
 Robinson - 1870. pp. 146-147.  
 Baker, J. G. - 1878 - p. 203.  
 DeCandolle, - Prodrum - Vol. 1, p. 50.  
 Loddiges - Bot. Cab. t 657  
 Davis, K. C. - In Bailey's Cyc. Hort. Vol. 1.  
 Anon., - The Garden IX - 1876, p. 384.

Good colored plate.

#### Synonyms:

- A. grandiflora*, Patr. ex DeCandolle, Syst. 1 - 337  
*A. montana*, Sterub. in Regensb. Denkschr. 11, 1818. 60.  
*A. Reuteriana*, Reichb. f. ex. Nym. Consp. 18.  
*A. Sternbergi*, Reichb Fl. Germ, Excurs. 749

1a - *A. alpina* var. *superba* (Hort).

A very pretty horticultural form of the above species, with white petal limbs. See plate 5.

Ref: - Davis, K. C. - In Bailey's Cyc. Hort. Vol. 1.





Plate 5 - *Aquilegia alpina* var. *superba*, Hort.



2. - A. baikalensis, Hort.

Plants vary in height from 14 to 42 inches.

Flowers short-spurred, in various shades of blue.

May - June. Seems to resemble A. Helena rather closely.

Of doubtful validity.

References:

---

Anon. - Royal Hort. Soc. Journ. Vol. 40, pt. 2,  
pp. 272-275, 1914.

3. - A. bertoloni, Schott.

Plant 1 to 1-1/2 feet high; stems slender, finely pubescent. Root-leaves glabrous, glaucous below, firm, with short, broad ultimate lobes, partial petioles 1/2 to 1-1/4 inches long with three sessile segments. Stem leaves small and little compound, with linear segments.

Flowers bright lilac in color. Sepals 1 inch long, oblong, more acute than in A. pyrenaica. Petal limb half as long as sepals, 1/3 inch broad, rounded at top. Spurs as long as lamina, very much curved. Stamens not exerted beyond petal limb. Follicles as in A. pyrenaica.

Range - Alpine region of the mountains of eastern France and northern Italy.

Barely distinguishable from A. pyrenaica, except by the narrower and more acute sepals. Should probably rank as a variety of the former.



References:

Schott - Verh. Zool. Bot. ver Wien. 1853 : 127

Saker, J. G. - Gard. Chron. 1878, p. 76

Synonyms:

*A. Reuteri* - Boiss, Diagn. Ser. 2, pt. 1, p. 10, 1854.

*A. pyrenaica* - Reich. Ic. Fl. Germ. tab. 4732  
non DeCandolle.

*A. pyrenaica* var. *decipiens*, Gren. Fl. France,  
Vol. 1, p. 45

4. - *A. brevistyla*, Hook.

Plant somewhat pubescent, erect, slender, 1 to 2 ft. high. Stems glabrous below, finely pubescent upwards. Root-leaves biternately divided, lobed and crenate, partial petioles 1 inch or longer, with 3 nearly sessile divisions, ultimate lobes deeper and narrower than in *A. vulgaris*, upper surface green, glaucous below. Lower stem-leaves petioled, biternate, upper sessile.

Flowers small, nodding, about as broad as long, quite numerous, 1/2 inch or more long. Sepals 1/2 inch long, oblong or oblong lanceolate, bright lilac or pale claret or white. Petal limbs shorter than sepals, 1/4 inch broad, nearly truncate at tip, creamy white. Spurs of same color as sepals, much incurved, knobbed, stout, shorter than petal limb. Stamens not exerted. Style very short, included. Follicles .317 cm. long, slightly spreading, with a short subulate beak. Styles the shortest in the genus.



Season - June and July.

Range - Western Canada as far north as Bear Lake. South Dakota to Alaska. Common about Banff, B. C. in open, rocky situation.

One of the few New World species to resemble *A. vulgaris* closely. Differs from *A. vulgaris* in having flowers only half as large, and in the shortness of the styles. Rydberg, (1896) says that this species is often confused with *A. saximontana*, a very closely related form, and that *A. brevistyla* is rare.

References:

- Hooker, W. J. - Fl. Bor. Amer. Vol. 1, p. 24.  
 Torrey, J. and Gray, A. - Fl. N. Amer. Vol. 1, p. 30.  
 Britton, N. L., and Brown - Illus. Flora. p. 93.  
 Brown, S. 1907. p. 105. Colored plate.  
 Baker, J. G. 1878. p. 20.  
 Rydberg, P. A. - 1896. p. 481.

Synonyms:

- A. vulgaris* - Richards. App. Frankl. Journ. Vol. 2, 21.  
 5. - *A. buergeriana*, Sieb and Zucc.

Plant about 1 foot high; more slender than *A. vulgaris*, stems finely pubescent above, glabrous towards base. Root-leaves with short, broad lobes, close together, glaucous below, partial petioles 1/2 to 1 inch long. Stem-leaves petioled, biternate, few in number.



Flowers 1 to 1-1/2 inches across, about five to a stalk. Sepals 3/4 inch long, spreading; yellow, tinted with clear purple, oblong-lanceolate, acute. Petal-limbs 1/2 to 5/8 inch long, cuneate, 1/2 inch broad, nearly truncate at tip, pale primrose yellow. Spurs as long as sepals and of the same color, nearly straight, erect, slender, not knobbed. Stamens not exerted. Follicles pubescent, 5/8 to 3/4 inch long. Style half as long.

Season - early.

Range - Japan. Introduced from St. Petersburg 1892.

#### References:

Sieb and Zucc. - Fam. Nat. Jap. No. 333.

Baker, J. G. - 1878. p. 20

Sieb and Zucc. Abh. Akad. Luench IV. II. 1846. 183

#### Synonyms:

*A. atropurpurea* - Miq. in Ann. Mus. Ludg. Bot. iii 8.  
Non Wild.

6. - *A. caerulea*, James.

Plant about 1 foot high, flowering branches 15 to 18 inches. Stems as stout and tall as in *A. vulgaris*, glabrous below, pubescent above. Root-leaves much more acutely notched and of finer texture than in *A. vulgaris*, ultimate lobes as deep and narrow as in *A. alpina*, slightly glaucous below, partial petioles 1 to 2 inches. Stem-leaves large, few, lower biternate.



Flowers 3 to 4 inches in diameter, rarely 5 to 6, somewhat solitary, almost erect, terminal. Sepals 1-1/4 to 1-1/2 inches long, half as broad, usually whitish more or less tinted with lilac, blue, or purple, oblong, obtuse, unguiculate, reflexing when full. Petals half as long as sepals, always white, very cuneate, rounded, not as broad as long. Spurs 1-1/2 to 2 inches, straight, slender, scarcely knobbed, of same color as sepals. Stamens equal with the petal-limb. Style about 1/3 inch. Follicles pubescent, 1 inch or more long.

Season April to July.

Range - In woods and on mountain sides from Montana to Utah and Colorado. Altitude 6,500 to 12,000 feet. Found sparingly on the Californian Sierra Nevada Mountains.

One of the most beautiful of all the columbines. Woolton and Standley (1915) say of it: "Few indeed are the flowers of the Rockies which can compare with this in beauty. The great blossoms, sometimes six inches in diameter, look like bits of fallen sky, and when the plants cover acres of meadow, as they sometimes do, no words can be found to do them justice."

English horticulturists recommend for this species a partial shade and a rich turfy loam. Dampness is often fatal to *A. saerulea* during the winter months.



The type locality for this species is on the divide between the Platte and the Arkansas rivers in Colorado.

*A. caerulea* is the state flower of Colorado.

References:

- James - Bot. Long. Exped. Vol. 11, p. 15.  
 Niven, J. C. - The Garden IX. 1877. p. 90.  
 Torrey and Gray - Fl. N. Amer. 1. p. 30.  
 Torrey, J. - Ann. Lyc. N. Y. Vol. 11 - 164-1827.  
 Baker, J. G. - 1878, p. 203.  
 Whittaker, J. - The Garden III. 1873. p. 464.  
 Woolton and Standley. 1915. pp. 248-248.  
 Watson, S. - 1871. p. 36.

Synonyms:

- A. coerulea* - auct.  
*A. leptoceras* - Nutt. in Journ. Ac. Phil. 7.  
 1834 - 9.  
*A. macrantha* - Hook. and Arn. in Bot. Beech. Voy.  
 317 to 72.

6a. - *A. caerulea* var. *alba* (Hort.)

Pure white, but otherwise like the type.

Reference:

Davis, K. C. - In Bailey's Cyc. Hort. Vol. 1.

6b. - *A. caerulea* var. *hybrida* (Hort.)

Petals white or yellow. Sepals blue or pink.

Thought to be a cross with *A. chrysantha*. Characters of this variety not well defined, except in the trade variety "Rose



Rose Queen = *A. caerulea* x *A. chrysantha* as male parent. Petals clear white. Sepals and spurs delicate pink.

6c. - *A. caerulea* va. *flore pleno*, Hort.

Flowers very showy. More or less doubled.

6d. - *A. caerulea* var. *candidissima* (Hort.)

A new double white. Advertised by Fottler, Fiske, Rawson Co., Boston.

7. - *A. canadensis*, L.

Plant 1 to 2 feet high, stems practically smooth, slender. Root-leaves finely cut; glabrous; glaucous below, biternately divided, ultimate lobes narrower and deeper than in *A. vulgaris*, and of thinner texture. Stem-leaves lower petioled, upper sessile, lower biternate and pale beneath.

Flowers several to a stem. Sepals 1/2 inch long, lanceolate, not reflexed, yellowish or tinted on back with red. petals slightly shorter than sepals, nearly truncate, yellow. Spurs 3/4 inch long, longer than petal-limb, nearly straight, thick in upper half, knobbed. Stamens and styles much exserted beyond petal limbs. Follicles about 2 cm. long, erect to slightly spreading. Styles about 1 cm. long.

An average of 400 measurements gives the following dimensions for the floral parts: Spur length 2.22 cm; lamina .95 cm; sepals 1.73 x .72 cm.

Season - May and June.

Range - Canada to Florida east of the Rocky moun-



tains. Reported in the Black Hills(Rydberg) and in western Florida.

(Chapman)

Britton says that this species consists of several races, differing in size and color of flowers, and in pubescence. Certain it is that specimens from different parts of this country and Canada do differ in many characters.

*A. canadensis* was well known to pre-Linnaean botanists and horticulturists. It was introduced into Europe by the younger Tradescant. Parkinson ("Theatrum" p. 1367) describes and figures it as "*Aquilegia virginiana* flore rubescente - the red columbine of Virginia." In Miller's *Icones*, tab. 47, it is spoken of as "*Aquilegia praecox pumila canadensis*."

West of the Rocky mountains *A. canadensis* is represented by *A. formosa*.

#### References:

- Linnaeus - Sp. Pl. Vol. 1. 1762. p. 535.
- Hook - 1840. p. 24. (As *A. formosa*).
- DeCandolle - Prodr. Vol. 1, p. 50.
- Curtiss - Bot. Mag. t 246.
- Davis, Z. C. - Bailey's Cyc. Hort. Vol. 1.
- Britton & Brown. Illus. Flora.
- Baker, J. G. -1878 - p. 20.



Loddiges - Bot. Cab. t 888.

Torrey and Gray - Fl. N. Amer. Vol. 1. p. 29.

Parkinson - Theatrum p. 1367.

Rydberg, P. A. - U. S. Nat. Herb. Cont. Vol. III.  
1896

Chapman, A. W. - 1865. p. 9.

Darby, John - 1856. p. 206.

Author unknown - Herb. Amat. t. 306.

Anon. - The Garden IX. p. 385.

7a. - A. canadensis var. nana, Hort.

Plant 1 foot or less in height. Flowers like those of the type.

7b. - A. canadensis var. flavescens, Hook.

A pale-leaved, yellow-flowered variety. Very pretty. Also called A. flavescens, Wats., A. flaviflora, Tenney; A. canadensis var. flaviflora, Britton.

7c. - A. canadensis var. hybrida, Hook.

Flowers purplish. of doubtful rank.

#### Reference:

Torrey and Gray. Vol. 1. p. 29.

8. - A. caryophylloides, Hort.

A trade name given to a group of mixed types. Not a species or variety in any sense of the word. The group has no distinguishing characteristics. It contains anything which the seedsman wishes to distribute under the



name *A. caryophylloides*.

Reference:

Davis, K. C. - In Bailey's Cyc. Hort. Vol. 1.

9. - *A. chrysantha*, Gray.

Plant 3 to 4 feet high in cultivation, shorter in wild state, with the general habit of *A. canadensis*. Root-leaves biternately divided, petioles 1 to 2 inches long, with 3 distinctly stalked divisions, ultimate lobes smaller and narrower than in *A. vulgaris*, upper surface bright green, glaucous below, texture thin. Lower stem leaves biternate.

Flowers many. Sepals lanceolate-oblong, scarcely longer than the lamina of the petals,  $3/4$  to 1 inch long, primrose yellow, tinted with claret at tip. Petal-limb  $2/3$  to  $3/4$  as long as sepals, nearly as broad as long; slightly rounded, notched at tip, deep lemon yellow, darker than sepals. Spurs  $1-1/2$  to 2 inches long, very slender, outcurved in varying degrees, yellow. Stamens exerted a little beyond lamina. Follicles glabrous, 1 inch long. Style as long as follicle. (See plate 6).

Season - Late. Nearly a month behind *caerulea*.

Range - Type locality. Organ mountains of New Mexico, eastern New Mexico and Arizona. Also reported in Colorado.



In range this species is more southerly and less alpine than *A. caerulea*. It resembles *A. caerulea* somewhat in size of flower and length of spurs, but differs in the yellow color, the much smaller sepals, outspreading spurs, and season.

*A. chrysantha* seems to prefer shaded places, well supplied with moisture. It begins to bloom long after the other species and continues to flower for a long time. At Ithaca, N. Y. it blooms after the middle of June and through July.

#### References:

Gray, A. - 1873 - p. 621.

Davis, K. C. - In Bailey's Cyc. Hort. Vol. 1.

Woolton and Standley, - 1915. p. 248.

Hooker, J. O. - Bot. Mag. Vol. 29. 1873.  
(As *A. leptoceras*) colored plate t 6073.

Coulter and Nelson - 1909. p. 191.

Standley, F. C. - Nat. Herb. Cont. 1910. p. 185.

Anon. - Amer. Agriculturist, Vol. 32, p. 341,  
Sept. 1873 (wood cut)

#### Synonyms:

*A. aurea* - Janka in Oestra. Bot. Zeitschr. 22 :  
1872 : 174.

*A. sulphurea* - Zinn, in Fünft Jahrea. Ber. Staats.  
ober Realsch Steyr (1875) - 38.

*A. leptoceras* var. *chrysantha*, Hook.





Plate 6 - *A. chrysantha*, Gray.





Plate 7 - *A. chrysantha*, Cray, and *A. vulgaris flore pleno*,  
Hort.



9a. - A. chrysantha var. flavescens, Hort.

Flowers yellow tinged with red. Spurs incurved and shorter than in type.

9b. - A. chrysantha var. alba plena, Hort.

Also called A. grandiflora alba. Flowers very pale yellow or nearly white, with 2 or more whorls of petal-limbs. Introduced into the trade in 1889.

9c. - A. chrysantha var. nana, Hort.

Also A. leptoceras var. lutea, Hort. Like the type, but plants always small, never exceeding 1-1/2 feet.

9d. - A. chrysantha var. Jaeschkani, Hort.

About same height as the last. Flowers large; yellow with reddish spurs. Thought to be a hybrid of A. chrysantha by A. Skinneri, hence sometimes called A. Skinneri var. hybrida, Hort.

The above descriptions of varieties are from Davis, in Bailey's Cyc. Hort. Vol. 1.

10. - A. ecalcarata, Eastwood.

Stems many from tufted base, pubescent with soft-spreading hairs. Root-leaves tri-ternately divided, above sparingly villous, and more viscid than below, leaflets cuneate, thin, somewhat three-lobed, petioled, long, slender petioles dilated at base into stipule-like sheaths.

Flowers 2 cm. across, many, on long slender pedicels. Sepals ovate lanceolate, thickened in middle. Petals



1.2 cm. x 2 mm. wide. Spurs sac-like, emarginate, ciliate and veiny. Whole flower a delicate pink or white. Stamens exerted beyond the petals a very little. Pellicles somewhat viscid and hairy.

Range - Mancos River canon, southwestern Colorado.

*A. ecalcarata* has never been seen except in one niche-like cavern where the sun never comes and where the water supply during the summer is so slight "that it is forced to cling close to the damp rocks, even climbing up the sides of the cave with its slender thread-like stems." Eastwood - 1911.

This species resembles *A. micrantha* very closely.

#### References:

Eastwood, Miss Alice - Zoe 11 - 1891

Eastwood, " " Proc. Cal. Acad. Sci. II  
1895 - 560.

Rydb. P. A. - Tor. Bot. Club Bul. 1902 : 146

Coulter and Nelson - 1909. p. 191.

#### Synonyms:

*A. mancosana* - Cockerell - in Torreyia 11 75

*A. Eastwoodie*, Rydb. Tor. Bot. Club Bul. 1902,  
p. 146

11. - *A. einseleana*, Schultz.

Plant small, 1/2 to 1 foot, slender, tending to produce but one stem. Stems glabrous below, pubescent above, bearing 4 to 8 flowers, each on long pedicels. Root-leaves



with short glandular hairs on both surfaces, partial petioles  $1/2$  to 1 inch long, segments distinctly stalked. Stem-leaves sessile, bract-like, simple, linear.

Flowers lilac-blue. Sepals about  $1/2$  inch long, oblong, acute, lilac-blue. Petals  $1/3$  inch broad, cuneate, nearly as long as sepal, pale blue or white. Spurs of same color as lamina, a little shorter than the blade, not swollen. Stamens equaling the lamina. Follicles  $3/8$  to  $1/2$  inch long, narrowing gradually to  $1/3$  inch - long slender style.

Range - Switzerland, Piedmont and Central Europe over limestone. Ascends to 6,000 feet.

This species is often confused with *A. pyrenaica*.

#### References:

Fr. Schultz - Arch. Fl. Fr. et Allem. 135

Baker, J. G. - 1898. p. 19.

Anon., - The Garden IX. 1876. p. 384.

#### Synonyms:

*A. viscosa* - Reichb. Fl. Germ. Excura 748.

*A. thalict trifolia* - Schott and Kotschy in  
Verh. Bot. Zool. wien, 1855-130.

*A. pyrenaica* - Koch. Syn. Fl. Germ. DC. 2. p. 24.

*A. confusa* - Rota Prosp. Fl. Bergamo. 99.

*A. Bauhini* - Schott in Verh. Bot. Zool.  
Ver Wien iii - 128



12. - A. elegantula, Greene.

Plant 2 to 4 dm. high, erect, glabrous, slender, leaves mostly radical. Stem-leaves few, small and subsessile. Flowers few or solitary, 3 cm. long. Sepals and petals yellowish green. Spurs longer than sepals, red, straight, inflated above. Styles exerted.

Range - Colorado and New Mexico. Occurs only on the higher mountains in deep woods, usually on the faces of cliffs. 7500 to 11,000 feet.

Resembles *A. canadensis* very closely.

References:

Greene - Pitt. 4 : - 14, 1899.

Coulter and Nelson. 1909.

Woolton and Standley. 1915. p. 248.

Rydberg, P. A. - Flora. Col.

13. - A. flabellata, Lieb and Zucc.

Plant as stout as *A. vulgaris*, but not so tall, stems glabrous below, finely pubescent above. Partial petioles of root-leaves 1 to 1-1/2 inches long, leaflets nearly sessile, ultimate lobes short, slightly glaucous above and much so below, texture as in *A. vulgaris*. Lower stem-leaves biternate and petioled. Flowers bright lilac or pale claret, purple, white. Sepals 1 inch long, oblong or ovate oblong, obtuse. Petals half as long as sepals, often white in lilac form, rounded at tip, 1/4 to 1/3 inch broad. Spurs shorter



than lamina, slender towards end. Stamens not exserted.

Season - Summer.

Range - Japan and Sachalin Isles.

A well-marked species, characterized by large flabellate bracts. Nearest *A. Sibirica*, but with a much shorter spur.

References:

Sieb and Zucc. - Abh. Akad. Muench. IV 11. 1846 : 183.

Carriere - Rev. Hortie. 1887. 548. fig. 116.

Baker, J. G. - 1878.

Davis, K. C. - In Bailey's Cyc. Hort. Vol. 1.

13a. - *A. flabellata* var. *nana alba*, Hort.

Also *A. flabellata* var. *flore alba*. Flowers pure white; plant dwarfish.

Reference:

Davis, K. C. - In Bailey's Cyc. Hort.

14. - *A. flavescens*, Watson.

Plant of the same habit as *A. canadensis*. Stems slightly pubescent above, branching freely, 3 to 5 dm. Foliage like that of *A. canadensis*, smaller and more delicate than in *A. formosa*, leaflets coarsely toothed. Lower stem leaves petioled and biternate.

Flowers many, pendulous, lemon-yellow, sometimes tinged with scarlet. Sepals oblong or oval, spreading or



reflexed, longer than limb of petal, yellow or sometimes slightly tinted with red on the back,  $1/2$  to  $3/4$  inch long. Petal-limb  $1/3$  to  $1/2$  inch long, obovate-cuneate, truncate, pale yellow. Spurs  $3/8$  to  $1/2$  inch, shorter than in *A. canadensis*, yellow, slightly incurved, knobbed. Follicles  $1/2$  to  $3/4$  inch long, pubescent. Style  $3/8$  to  $1/2$  inch.

Range - Subalpine zone of Rocky mountains in Utah and Oregon, 5,000 to 7,000 feet.

References:

S. Watson - Bot. King's Exp. 10. 1871.

Coulter and Nelson - 1909. p. 191.

Piper, C. V. - U. S. Nat. Herb. XI. 1906. p. 279.

Henshaw, J. W. - 1906. p. 262. pl. 74.

Brown, S. - 1907. p. 106.

15. - *A. formosa*, Fisch.

Plant of same habit as *A. canadensis*, more slender than *A. vulgaris*. Stems nearly or quite glabrous, not as leafy as in *A. canadensis*. Foliage abundant and fern-like when well supplied with moisture, leaves tri-ternately divided, broadly wedge-shaped, glaucous below and slightly so above, ultimate lobes stalked. Stem-leaves petioled, lower biternate.

Flowers longer and brighter than in *A. canadensis*, scarlet and drooping. Sepals  $3/4$  inch, rarely 1 inch long, ovate-lanceolate, spreading or reflexed, bright red. Petals



half as long as sepals, yellow, nearly truncate. Spurs  $1/2$  to  $3/4$  inch long, nearly straight, knobbed, slender in lower half, scarlet. Stamens exerted much beyond lamina. Style as long as sepals. Follicles glabrous, 1 inch or less. Style half as long.

Season - Late June and July.

Range - Sitka to California and east to the Rockies. Utah. New Mexico. Damp woods. Prefers moist ground. Listed from Kamtschatka by DeCandolle (Prodr. Vol. 1), but not accepted as a Siberian plant by other writers.

Much like *A. canadensis*, but with larger sepals which are fully twice as long as the petal-limb.

#### References:

- Fisch in D. C. Prodr. Vol. 1. p. 50.  
 Torrey and Gray - Fl. N. Amer. Vol. 1. p. 30.  
 Davis, K. C. - In Bailey's Cyc. Hort. Vol. 1.  
 VanHoutte - Flore des Serres, Vol. 8 (1852-3)  
                   p. 125 - t 795. Colored plate.  
 S. Wats. Bot. 40. Parallel.  
 Woolton and Standley. 1915. p. 248.  
 Brown, S. 1907. pp. 106-7. Col. plate.  
 Henshaw, J. W. - 1906. pp. 135-136. Plate.

#### Synonyms:

- A. artica* - Loud. Hort. Brit. 610.  
*A. canadensis* - Fl. Bor. Amer. 1. 24.





Plate 8 - *A. formosa* var. *hybrida*, Hort.



*A. eximia* - Van Houtte, ex. Planch. in Fl. des Serres. Ser. 2. ii. 185 - 7:13, t 1188.

15a. - *A. formosa* var. *nana alba*, Hort.

Flowers pale, often nearly white; plant not exceeding 1 foot.

15b. - *A. formosa* var. *rubra pleno*, Hort.

Flowers as in *A. formosa* var. *hybrida*, but with several whorls of petal-limbs.

15c. - *A. formosa* var. *hybrida*, Hort.

Flowers large with yellow petals and scarlet sepals, spurs spreading, long and slender. A supposed natural hybrid with *A. chrysantha*. Plant about 3 dm. high. Stem-leaves nearly sessile, glaucous below. Flowers 5.7 cm. broad x 5.5 cm. long. Spurs 3 cm. long, scarlet, straight, slightly knobbed. Lamina 1 cm. long, bright yellow. Sepals 2.9 cm. x 1.1 cm., scarlet to Brazil red. Stamens exerted by 1.3 cm. styles by 1.4 cm.

16. - *A. fragrans*, Benth.

Plant 1-1/2 to 2 feet; flowers few; stems more slender than in *A. vulgaris*, finely pubescent above. Leaves with partial petioles 1 to 2 inch long, with 3 distinctly stalked divisions, as thin as in *A. alpina*, slightly glaucous below. Stem-leaves biternate, lower petioled.

Flowers white or pale claret-purple, very fragrant. Sepals 1-1/4 to 1-1/2 inch long, half as broad, ovate, sub-acute, not reflexing. Petal-limbs 3/4 inch broad, very cune-



ate and rounded. Spur slender, slightly curved, barely knobbed, short. Stamens not exerted. Styles exerted by 1/3 inch. Follicles pubescent, 3/4 to 1 inch long.

Range - Temperate region of western Himalayas, Kashmir and Kistwar, 8,000 to 10,000 feet. Introduced into England about 1840 by the Royal Horticultural Society.

References:

Benth, in Maund Bot. Vol. IV. t. 181.

Baker, J. G. - 1878. p. 203.

17. - A. glandulosa, Fisch.

Plant 1 to 1-1/2 feet high. Stems glandular pubescent above. Partial petioles of root-leaves 1 to 2 inches long with 3 distinctly stalked divisions, ultimate segments narrower and deeper than in *A. vulgaris*, slightly glaucous below. Stem-leaves few and bract-like. Flowers large and nodding. Sepals 1-1/2 inches long, ovate, unguiculate, acute, fully half as broad as long, bright lilac-blue. Petals less than half as long as sepals, cuneate, rounded at top, as broad as long, lilac-blue, tipped with creamy white. Spurs 1/4 to 1/3 inch long, stout, incurved. Stamens not exerted beyond lamina. Styles falcate, divergent. Follicles 1 inch long, densely pilose.

Season - Early in summer.

Range - Altai mountains and other districts of Central Siberia along edges of mountain streams.



Allied to *A. alpina*, but taller, with larger flowers and shorter spurs. Very handsome. *A. Whitmanni*, Hort. is somewhat like this species.

*A. glandulosa* is excellent for rock gardens. The plants often die after the first year and should therefore be treated as biennials. They do best in a rich, mellow soil which is cool and moist. English horticulturists have found it very difficult to raise this plant with any success. It does very well in Highlands of Scotland, however.

#### References:

- Fisch - Hort. Gorenk. ed. II. 1812 :48  
 DeCandolle - Prodr. Vol. 1. p. 50.  
 Davis, K. C. - In Bailey's Cyc. Hort. Vol. 1.  
 Douglas, J. - The Garden 16 : 264 (1879)  
 Dod, C. Wolley - The Garden 17 : 76 (1880)  
 Robinson, W. - 1870. p. 147.  
 Baker, J. G. - 1878 : 203.  
 Anon. - The Garden 9 : 384.

17a. - *A. glandulosa* var. *juncunda*.

Flowers smaller than in type, with white petal-limbs which are more truncate than in the type.

#### Reference:

- Baker - 1878. p. 203.  
 Davis - In Bailey's Cyc. Hort.



18. - A. glauca, Lindl.

Plant 1 to 1-1/2 feet high, glaucous, glabrous below and finely pubescent above. Partial petioles of root-leaves 1-1-1/2 inches long with distinctly stalked segments, broad, shallow lobes, thin texture, both surfaces glaucous and glabrous. Lower stem-leaves biternate.

Flowers fragrant, white tinted with claret. Sepals 1 inch long, not reflexing, ovate, sub-obtuse, 1/2 inch broad. Petal-limb cuneate-truncate, 3/8 to 3/4 inch long and nearly as broad. Spur 1/4 to 1/3 inch long, straight or nearly straight or very slightly curved. Stamens as long as the lamina. Follicles pubescent; styles recurved, nearly as long as follicles.

Range - Temperate region of western Himalayas. Introduced into cultivation by the East India Company in 1846.

References:

Lindl - In Bot. Reg. 1846. tab. 46.

Baker - 1878 - p. 76.

19. - A. hayloadensis, Hort.

W\_\_\_\_\_, The Garden XIII, 1878, p. 537, believes it identical with *A. caerulea* var. *hybrida* and of the same parentage, *A. caerulea* x *A. chrysantha*.

The plants of this variety which were examined by the writer proved to be a badly mixed lot with no distinct



type prevailing.

19a. - A. haylodgensis var. delicatissima, Hort.

"A new hybrid, bearing large, long-spurred flowers, the spurs being a tender satin-rose, passing imperceptibly to a delicate light yellow at the crown."

Dreer - catalogue 1915.

20. - A. helena, Hort.

"A strong robust grower, 15 to 20 inches high, with numerous very large blue flowers and wide, expanded pure white corolla. Similar to caerulea, but with shorter spurs."

Dreer - catalogue 1915.

Flowers 3.4 cm. wide x 2.4 cm. long, stout.

Sepals 2.20 x .85 cm., dark prune purple. Petals 1.25 cm., whitish. Spurs 1.15 cm. long, mulberry purple, curved, scarcely if any knobbed.

21. - A. Jonesii, Parry.

Plant about 3 inches high; stems minutely soft pubescent. Root-leaves tufted; partial petioles very short, if any, biternately divided, leaflets very crowded. Sepals oblong, blue. Petals half as long as sepals, blue. Spurs shorter than sepals, nearly straight, gradually tapering. Styles exserted beyond petal-limb. Follicles turgid, smooth, nearly 1 inch long.



Season - June and July.

Range - Phlox mountain, Wyoming, and in Montana.

A very dwarf plant. Dedicated to Captain W. A. Jones, U. S. Engineer, who was commander of the expedition on which this species was collected. An alpine plant found on the high peaks of the central Rocky mountains.

References:

Parry, C. C. - Amer. Nat. 8 : 211 - 1874.

Davis, E. C. - In Bailey's Cyc. Hort. Vol. 1.

Sydberg, P. A. - Vol. III - 1896 - p. 482.

Coulter and Nelson - 1909. p. 192.

22. - A. kitaibelii, Schott.

Plant short, 1 foot or less, slender. Stems short, slightly viscose, pubescent. Partial petioles of root-leaves 1 to 1-1/3 inches, 3 segments 1 inch long, lobes deeper than in *A. einseleana*, both sides of leaves finely pubescent. Stem-leaves sessile, mere bracts. Sepals 1/2 to 5/8 inch long, oblong, acute. Petal-limbs as long as sepals, rounded at top. Spurs shorter than petal-limb, decidedly incurved, knobbed. Whole flower blue-lilac. Stamens not exerted beyond petal limb. Follicles 1/2 inch long, densely pubescent.

Range - Hilly tracts in the southeast of France.



References:

Baker, 1878 - p. 19 - As *A. viscosa*.

Gonon. - Fl. Monap. p. 267. Tab. 19. fig. 1.

DeCandolle - Prodr. Vol. 1. p. 50.

Synonyms:

*A. viscosa*, Gonon.

23. - *A. lactiflora*, Kar and Kir.

Plant similar to *A. vulgaris* in habit. Stems finely pubescent above, 1-1/2 feet high. Segments of root-leaves short-stalked, thin, 1 inch long, glabrous on both surfaces, ultimate segments round oblong. Stem-leaves petioled, compound. Flowers nearly white or tinged with blue. Sepals 5/8 to 3/4 inch long, oblong lanceolate. Petal limb half as long as sepals. Spurs 1/3 inch long, slender, nearly straight. Stamens not exerted beyond petal-limb.

Season - June.

Range - Native of the Altai mountains of South Central Siberia.

A little known species, which closely approaches *A. pubiflora* of the Himalayas.

References:

Kar. and Kir - Bul. Soc. Nat. (Moscow)

Baker, J. G. - Gard. Chron. 1878.

Walp. Rep. Vol. 1, p. 50



Davis, K. C. - Bailey's Cyc. Hort. Vol. 1.

24. - A. laramiense, A. Nels.

Many-stemmed, from a rather large semi-fleshy root, 1-2 dm. high; stems and petioles more or less decumbent and diffuse; leaves biternate; the leaflets large, with crenate lobes, slightly pubescent below; inflorescence and fruits pubescent; flowers 10-15 mm. long; sepals greenish-white, lanceolate, with emarginate apex; lamina of the petals cream color, elliptical, obtuse, longer than the slender hooked knobbed anthers.

Range - Shaded cliffs in the Laramie range,

Wyoming.

References:

A. Nelson - First Rep. Fl. Wyo. 78. 1896.

Coulter and Nelson. (1909) p. 191 - 192.

25. - A. leptoceras, Fisch and Mey.

Plant of the stature of *A. canadensis*. Stems about 1 foot high, glabrous. Segments of root-leaves with deeper, narrower teeth than in *A. vulgaris*, thin, glabrous, biternately divided. Lower stem-leaves petioled, biternate, Sepals  $3/4$  inch long, half as broad, oblong, subacute, bright lilac-blue. Petal-limbs half as long as sepals, rounded at tip, yellow at tip. Spurs half as long as lamina, slender, slightly curved. Stamens exserted beyond the petal-limb a little. Follicles slender, glabrous, nearly 1 inch long;



style 1/4 inch long.

Season - Summer.

Range - Eastern Siberia.

A little known species. Resembles *A. canadensis* a little in the cutting of the leaves and the less incurved petal-spur. Cultivated at the Botanical Gardens of Birmingham, England in 1838.

References:

Fisch. and Mey. - Ind. Sem. Hort. Petrop. IV.

Ledeb. - Fl. Ros. Vol. 1. p. 57.

Mannl. in Bot. Gard. t 755. Small col. pl.

Baker - Gard. Chron. 1878. p. 76.

Davis, K. C. In Bailey's Cyc. Hort. Vol. 1.

Synonyms:

*A. brachyceras* - Turcz - Fl. Baic. Vol. 1. p. 68.

26. - *A. longissima*, Gray.

Stem somewhat pubescent with silky hairs, 3 feet high. Segments of leaves deeply lobed, narrow, glaucous below. Flowers "lake white and straw yellow" (Gray). Sepals lanceolate, 1 to 1-1/4 inches long. Petal-limbs 3/4 inch long, spatulate. Spurs hanging, slender, 4 inches or more long, spur opening very narrow. Stamens not exerted.

Season - Late July to October 1st.

Range - Caracol mountains, south of Monclova, Coahuila. Ravines of southwestern Texas into Mexico.



Allied to *A. caerulea* and *A. chrysantha*, but distinguished by narrower petals and constricted mouth of long spur.

References:

Gray, A. - Ex. S. Wats. in Proc. Amer. Acad.

XVII - 1881-82. p. 317.

Coulter, J. M. - U. S. Nat. Herb. Cont. Vol. II,  
p. 9.

Davis, K. C. - Bailey's Cyc. Hort. Vol. I.

27. - *A. madreensis*, Rose.

Stems about 3 feet high, much branched above and pubescent glabrate below. Basal leaves long-petioled, ternate; leaflets usually on slender petioles, sometimes sessile, cuneate at base, irregularly cut or lobed, pale green above, paler below, pubescent. Flowers nodding. Sepals broadly ovate, acuminate, 15 to 18 mm. long, puberulent. Petals with a greenish rounded limb. Spur 4 cm. long, very much contracted below middle, pale red in color. Follicles 5, strongly nerved.

Collected on the Sierra Madre west of Balanos in September, 1897.

Plant taller than *A. Skinneri*, with broader sepals, paler flowers, and pubescent. Rose believes *A. Skinneri* to be a Guatemalan species and thinks that most of the Mexican forms belong to *A. madreensis*.



References:

Rose, J. N. - U. S. Nat. Herb. Cont. 1909. p. 265.

28. - A. micrantha, Eastwood.

Lower part of stem and leaves unknown; upper part villous with white hairs, viscid. Petioles dilated at base, stipule-like margins, which are very viscid and villous. Upper leaves almost sessile; leaflets cuneate, 3-cleft or irregularly divided with rounded obtuse or acute lobes, under side more viscid and hairy than upper. Flower about 2 cm. across, cream-white. Sepals 10 mm. long, 4 mm. broad, ovate, acute, somewhat hairy and viscid on back. Spurs straight or curved, varying in length. Petal-limb truncate, 7 mm. long by 5 mm. broad. Stamens and styles exerted beyond petal-limbs. Follicles about 15 mm. long; styles about same length; viscid and villous.

Range - Abundant in canons of SanJuan River in southeastern Utah, "under shady cliffs where rocks and soil are almost always moist from oozing of alkali waters." Similar in growth and habit to *A. esalcarata*.

Described from a fragment of a plant.

References:

Eastwood, Miss Alice - Two species of *Aquilegia* from the upper sonoran zone of Colorado and Utah. Cal. Acad. Sci. Proc. 2nd Ser. Vol. IV - 1893-94. pp. 559-562. Pls. XVIII-XIX.



29. -

A. moorcroftiana, Wall.

Plant slender, about 15 inches high. Stems finely pubescent. Segments of root-leaves few, glaucous, with short glandular hairs, ultimate lobes about as broad and shallow as in *A. vulgaris*. Lower stem-leaves petioled and biternate.

Flowers white with a lilac tint. Sepals  $\frac{3}{4}$  inch long, half as broad, reflexing, oblong or lanceolate. Petal-limbs cuneate, nearly as long as sepal,  $\frac{1}{2}$  inch broad. Spur slender, scarcely knobbed, erect, rigid. Stamens not exerted beyond petal-limb. Follicles pubescent, contiguous,  $\frac{5}{8}$  to  $\frac{3}{4}$  inch long. Styles  $\frac{3}{8}$  inch long.

Range - Temperate region of Western Himalayas, at an elevation of 10,000 to 14,000 feet. Introduced into English gardens in 1852. Recently found at Kanaora, Tibet, and hence sometimes called *A. kanaoriensis*.

References:

Wall - Cat. N. 4713

Jacquem - ex. Camb. in Jacquem Voy. Bot. 7. t 5.  
as *A. Kanaoriensis*.

Anon. - The Garden, IX, p. 385.

Synonyms:

*A. kanaoriensis*.

30. -

A. oreophila, Rydb.

Plant resembling *A. chrysantha*, *A. caerulea*, and *A. flavescens*; 2 to 4 dm. high. Flowers few, 3 to 4 cm. long.



Sepals oblong lanceolate, acute, pale blue, longer than the oval, obtuse, ochroleucous limb of the petals. Spurs straight, widening regularly at the throat, ochroleucous or bluish, about twice as long as the limb. Middle elevations of northwestern Wyoming to Idaho and Montana.

References:

Rydberg, P. A. - Tor. Bot. Club Bul. 29 : 146. 1902.

Coulter and Nelson, 1909, p. 191.

31. - A. oxysepala, Traut and Mey.

Plant 2-1/2 feet high, slightly pubescent above.

Root-leaves long petioled, secondary divisions sessile. Sepals blue, ovate-lanceolate, much exceeding in length the petal-limbs. Petal-limbs 1/2 inch long, white, round truncate. Stamens not exerted beyond petal-limbs. Spurs knobbed, bent inward, shorter than petal-limb. Follicles pubescent. According to F. H. Horsford, it is one of the first to bloom and the flowers are all fertilized before other species come into flower.

Range- Siberia.

References:

Traut and Mey. In Middend, Reise (Fl. Ochot. 10)

Davis, K. C. - In Bailey's Cyc. Hort. Vol. 1.



32. - A. parviflora, Ledeb.

Plant rarely over 1 foot high, slender. Segments of root-leaves sessile, 1/2 to 1 inch long, glaucous, firm. Stem-leaves small and bract-like, with linear divisions. Flowers the smallest in the genus, light blue or light claret or white. Sepals 1/4 to 3/8 inch long, ovate or oblong. Petal-limbs half as long, as sepals, obtuse, cucullate. Spurs 1/8 inch long, stout, curved. Follicles 1 inch long at the most. Style 3 inches.

Range - Eastern Siberia.

References:

Ledeb in Mein. Acad. Petersb. V. 1814. 544.

DeCandolle, Prodr. Vol. 1, p. 51.

Baker, J. G. - 1878. p. 20.

Author unknown - Fl. Ross, Vol. 1. p. 57.

33. - A. pubescens, Coville.

Stem 2 to 3 dm. high, glabrous below, sparingly clammy haired near inflorescence. Root-leaves on slender glabrous petioles, 10 to 20 cm. long, simply ternate; leaflets 3-parted to 3-divided, divisions sessile, cuneate, obovate, minutely but densely pubescent beneath, less so above. Stem-leaves single or none, passing from those similar to radical leaves to linear bracts. Flower canary yellow. Sepals linear oblong, bluntly acute, 20 to 25 mm. long. Petal-



limb 6 to 10 mm. long. Spur about 25 to 30 mm. long. Fruit not seen.

Collected on the Death Valley Expedition, 1891, at an altitude of 3,000 meters in the Sierra Nevadas.

References:

Coville, F. V. - 1893. Vol. 4. pp. 56-57.

Hall and Hall, 1912, p. 98.

34. - A. pubiflora, Wall.

More slender than *A. vulgaris*, 1 to 2 feet high, stems finely pubescent. Root-leaves with broad, shallow lobes, glaucous above, thinner than *A. vulgaris*. Stem-leaves large petioled, lower biternate. Flowers pale blue or pale claret. Sepals  $1/3$  to  $3/4$  inch long, oblong or oblong lanceolate, acute, finely pubescent, not reflexed. Petal-limbs  $3/8$  to  $1/2$  inch long, obovate, rounded,  $1/3$  inch broad. Spurs  $1/4$  inch long, much incurved. Stamens not exerted beyond lamina. Follicles  $1/2$  to  $5/8$  inch long, narrowing suddenly into a style of nearly the same length.

Range - Wide. Through temperate western half of Himalayas to 10,000 feet.

References:

Wall - Cat. n. 4714.



35. - A. pyrenaica, D. C.

Plant dwarf, a few inches high, never over 1 foot, finely pubescent stems. Partial petioles of root-leaves  $1/2$  to 1 inch long, with 3 nearly sessile segments, slightly glaucous below, broad, round, coarse lobes, both surfaces glabrous. Stem-leaves small, slightly compound. Flowers bright lilac blue. Sepals 1 inch long,  $1/2$  to  $3/4$  inches broad, ovate. Petals half as long as sepals, obovate, cuneate, rounded at top. Spurs  $5/8$  to  $3/4$  inch long, nearly straight, slender, scarcely knobbed. Stamens not protruding. Style about half as long as follicle.

Range - Confined to the Pyrenees, where it is abundant.

Much like *A. alpina*, but with longer and more slender spurs, smaller petals, more dwarf and more glaucous plant. Not often found in cultivation, but good in rock gardens.

References:

DeCandolle - Fl. Fr. IV. 912.

" " Prodr. Vol. 1. p. 50.

Anon. - The Garden - IX. 1876. p. 384.

Anon. - The Garden - I. 1872. p. 674.

Synonyms:

*A. viscosa* - Suffr. ex. Reichb. 749.

*A. cyclophylla* - Jeaub. and Limb. in Bul. Soc. Sc. Phys. et Nat. Loulouse 111, 555.

*A. alpina* - Lam. Encyc. i. 150.



36. - A. saximontana, Rydb.

Plant 12 to 15 cm. high, glabrous, densely tufted. Stems smooth, scarcely exceeding the leaves. Root-leaves small, biternate. Segments 8-15 mm. long. Stem-leaves petioled and biternate. Flowers small, 12 to 18 mm. long. Sepals blue or greenish, acute or obtuse. Petals shorter than sepals and longer than spurs, yellowish. Spure blue, Stamens not protruding. Ovary smooth. Follicles 1.5 to 2 cm.

Range - High peaks in central Rockies. Colorado 10,000 to 12,000 feet.

Frequently mistaken for *A. brevistyla*.

References:

Rydborg - In Gray. Syn. Fl. 1. 43, 1895.

" Flora Col.

" 1896 - Vol. III : 482.

Coulter and Nelson - 1909. p. 192.

Jones, Zoe IV - 258. 1893.

Porter and Coulter, Fl. Col. 4 : 1874.

Synonyms:

*A. vulgaris* var. *brevistyla* - Gray. Amer. Journ. Sci. Ser. 2. 33 : 410.

37. - A. sibirica, Lam.

Plant 1-1/2 to 2 feet high, glabrous. Partial petioles of root-leaves 1 to 2 inches long, 3 sessile segments, ultimate lobes shallow or broadly rounded, glaucous below and



slightly so above, of the texture of *A. vulgaris*. Lower stem-leaves petioled and biternate. Flower bright lilac blue or pale claret. Sepals 1 to 1-1/4 inches long, oblong or ovate-oblong; broader than in *A. vulgaris* and more obtuse. Petal-limbs half as long as sepals, rounded at tip, nearly as broad as spur, often white. Spur 1/2 to 3/4 inch long, moderately stout, much incurved, even coiled. Stamens not protruding. Follicles 1 inch long, glabrous; styles 1/3 inch.

Range - Eastern half of Siberia; Altai mountains and hills of Dauria.

Very much like *A. vulgaris*. Differs in the broader and more obtuse sepals, slightly longer spur and glabrous follicles.

#### References:

Lam. Encyc. 1, p. 150.

DeCandolle, Prodr. 1 : 50.

Led. Fl. Ross, Vol. 1 : 56.

Sweet, Brit. Gl. Gard. - Ser. 11 - t 90.

Baker, J. G. - Gard. Chron. 2nd Ser. 10 : p. 111.

Davis, K. C. - Bailey's Cyc. Hort. Vol. 1.

#### Synonyms:

*A. bicolor* - Ehrh. Pl. Select. No. 115.

*A. speciosa* - D. C. Syst. Vol. 1. p. 336.

*A. garnieriana* - Sweet. Brit. Fl. Gard. Ser. 11  
t 103.

*A. spectabilis* - Lemaire, in Ill. Hort. t 403.



37a. - A. sibirica var. spectabilis, Baker.

A large, bright lilac flowered variety. Petal-limbs tipped with yellow.

Synonym:

A. spectabilis, Lemaire.

37b. - A. sibirica var. flore pleno, Hort.

Flowers very much doubled by a multiplication of both limbs and spurs.

The A. bicolor of horticulture.

38. - A. Skinneri, Hook.

Plant of the same habit as A. canadensis, 1 to 2 feet high, glabrous. Root-leaves long-petioled, glaucous below, ultimate lobes broadly rounded, deeper than in A. vulgaris. Flowers many, nodding, sepals  $3/4$  to 1 inch long, green, keeled, lanceolate, acute, ascending. Petal-limbs half as long as sepals, truncate, greenish orange. Spurs over 1 inch long, bright red, slender in lower half, tapering rapidly, slightly incurved. Stamens exerted far beyond limb of petal. Follicles, at least when young, with broad membranous curled wings.

Season - July to September.

Range - Mountains of Guatemala.

Introduced by Skinner in 1840. A distinct species; very pretty. Does well in sunny border and in light soil.

References:

Hook, in Bot. Mag. t 3919.



Baker, J. G. - Gard. Chron. 1878. p. 111.

Davis, K. C. - In Bailey's Cyc. Hort. Vol. 1.

Douglas, J. - The Garden - 1870. p. 264.

Anon. - The Garden, IX. p. 385.

38a. - A. Skinneri, var. flore pleno, Hort.

Flowers double, very fine.

Davis, K. C. - In Bailey's Cyc.

39. - A. stuarti, Hort.

A recorded hybrid of *A. glandulosa* and *A. vulgaris* var. *olympica*. Flowers very large and beautiful. It much resembles the latter parent in form of petals and sepals, and the former in shape of spurs and color.

Introduced 1891.

Season - May and June.

#### Reference:

Davis, K. C. - In Bailey's Cyc.

40. - A. truncata, Fisch and Mey.

Plant 1 to 3 feet high, glabrous, stems finely pubescent above. Leaves biternately divided. Sepals reflexed, orange, blunt pointed. Petals truncated, very little developed, yellow at margin, shading to deep orange. Spurs long, more attenuated than in *A. Skinneri*, scarcely longer than sepals, bright orange. Flower nodding.

Range - California.



Does well in a moist, deep, sandy loam. Old plants quite apt to die after blossoming.

References:

Fisch and Meyer - Ind. Sem. Hort. Petrop. 1843. p. 8.

Coville, F. V. - U. S. Nat. Herb. Cont. IV. 1893. 57.

Synonyms:

*A. formosa* var. *truncata* - Baker. 1878. p. 111.

*A. californica*, Hartweg - Gard. Chron. 1854.  
p. 836. Woodcut.

*A. eximea*, Planch, in Flore des Serres, 1857,  
tab. 1188.

It seems likely that *A. californica*, Gray, belongs here.

41. - *A. viridiflora*, Pallas.

Plant more slender than in *A. vulgaris*. Stems 1 to 1-1/2 feet high, finely pubescent throughout. Root-leaves thinner than in *A. vulgaris*, slightly glaucous below, ultimate lobes narrow and deep. Stem-leaves large petioled, bi-ternate. Sepals 3/8 to 1/2 inch long, oblong, nearly as broad as long. Spurs 1/2 to 5/8 inch long, straight, slender, greenish. Stamens exserted beyond lamina. Follicles 1/2 to 3/4 inch long, pubescent. Styles as long as follicles.

Range - Eastern Siberia.

The type runs by gradual transitions into the better known *A. viridiflora* var. *atropurpurea*. Commonly called the "green columbine."



References:

Pallas - In Act. Petrop. - 1779, p. 260, tab. 2.

Led. - Fl. Ross. Vol. 1. p. 57.

DeCandolle, Prodr. Vol. 1, p. 51.

Baker, J. G. - Gard. Chron. 1878. p. 111.

Anon. - The Garden - IX. 1876. p. 384.

41a. - A. viridiflora var. atropurpurea, Willd.

Differs from the type in having the petals a deep chocolate color.

Davis, K. C. - Bailey's Cyc. Hort. Vol. 1.

Anon. - The Garden, XX, p. 312.

Synonyms:

A. atropurpurea.

42. - A. vulgaris, L.

Plant 1-1/2 to 2 feet high, stems finely pubescent throughout. Leaves bi- or triterminate, ultimate lobes shallow and roundish, leaf segments broad, glaucous below and slightly so above, texture firm. Lower stem-leaves petioled and bi-ternate. Flowers many, drooping, bright lilac, blue or purple. Sepals 1 inch long, half as broad, ovate, unguiculate, acute. Petal-limbs 2/3 to 3/4 inch long, half as broad, rounded at apex. Spurs 3/4 inch long, much incurved, distinctly knobbed. Stamens not protruding. Follicles 1 inch long, densely pubescent. Style half as long.

Season - Summer.



Range - Throughout nearly all Europe and into Siberia.  
 The only British species now naturalized in parts of America.  
 The type species of the genus. The most commonly grown species.

References:

- Linnaeus - Sp. Pl. Vol. 1. 1762. 752.  
 DeCandolle, Prodr. Vol. 1. p. 51.  
 Baker, J. G. - Gard. Chron. 1878. p. 76.  
 Davis, K. C. - Bailey's Cyc. Hort. Vol. 1.  
 Britton and Brown - Fig. 1869.  
 Benthams, Geo. - 1865. pp. 21-22.  
 Engl. Bot. tab. 294. 4 ed. tab. 46.  
 Reich. Ic. Fl. Germ. tab. 4279.  
 Fl. Dan. t 695.  
 Anon. - The Garden, IX, 1876. p. 384.

Synonyms:

- A. stellata, Hort.  
 A. atrata, Koch.  
 42a. - A. vulgaris var. flore pleno, Hort.- Plate.

Flowers much doubled, ranging from pure white to deep blue. Here belong many horticultural varieties with personal names.

Davis - Bailey's Cyc. (See plates 7 and 9).



42b. - A. vervaeneana, Hort.

Leaves with yellow-variegated lines. Also var. *atro-violacea*, Hort.

Davis.

42c. - A. vulgaris var. nivea, Baumg.

Munsted's white columbine. Often 2-3 feet high. A great profusion of pure white flowers for several weeks in early spring. (See plate 12).

Davis.

42d. - A. vulgaris var. olympica, Baker.

A fine variety with several large flowers. Sepals light lilac or bright purple, 1 inch or more in length. Petal-limbs white.

Synonyms:

*A. olympica*, Boiss.

*A. whitmaniana*, Hort.

*A. blanda*, Lem.

42e. - A. vulgaris var. hybrida, Sims.

Much like the preceding, but with stoutish, lilac-purple spurs as long as the sepals, only slightly incurved. Probably a hybrid of *A. vulgaris* and *A. canadensis*.

To these varieties there should probably be added *A. vulgaris* var. *stellata*, Hort., to include the spurless forms of *A. vulgaris*. These spurless types are quite dis-



tinot and they are surely deserving of a place as a horticultural variety. ( See plates 10 and 11.)





Plate 9 - *A. vulgaris* var. *flore pleno*, Hort.





Plate 10 - *A. vulgaris* var. *stellata*, Hort.





Plate 11 - Showing partly spurred and spurless flowers from  
the same plant of *A. vulgaris*, L.





Plate 12 - Plant of *A. vulgaris* var. *nivea*, Baumg.



D I S T R I B U T I O N



### Distribution of Columbines

The columbines of the world are found only in the northern hemisphere. At least no species have been reported from the southern countries. There are five distinct geographic ranges for the columbine, each with a flora of its own. In no case is there any overlapping of species belonging to the different zones; that is, the species of one district are indigenous only to it. (See map 1.)

The districts in which *Aquilegias* grow may be designated as follows: (1) the North America district, (2) the Central Europe district, (3) the India district, (4) the Siberia-Japan district, and (5) the Himalaya Mountains district.

The North America district extends at the east from near Hudson Bay to western Florida. At the south it runs into the Ozarks and down into Mexico, with one species in Guatemala. The western forms are found largely in the mountains and hills. In general they follow the Rocky Mountains and the Cascades and Sierra Nevadas, running up into Canada as far as Bear Lake and to Sitka, Alaska. The American columbines are largely of the straight-spurred type and the members of the red-yellow-green group predominate. The distribution of the more important American species are shown in maps 2-8. It must be understood that the ranges blocked out on the maps are only approximately correct.



The Central European district extends from northern Russia, middle Norway and middle Scotland into Italy and northern Greece. In it are found members of the blue-white group, almost entirely, and species with curved spurs. (See maps 9-12).

The *Aquilegiae* of India are restricted to the mountains of the northern part. They are evidently related to the species of the Himalayas.

The Siberia-Japan columbines are found in Japan and in the mountains of central and south-central Siberia, chiefly the Altai Mountains. These forms are closely related to the European species, but their range is quite distinct and there is no overlapping of ranges. (See maps 13-15).

The Himalayan species are found in the temperate regions of the Himalaya Mountains, at altitudes of 8,000 to 10,000 feet. (See maps 13-15).



Maps showing the  
Distribution  
of  
Columbines































































### Soil and Exposure

It is generally held by those who have had experience growing columbines that the plants do best in a medium light soil, moderately rich in plant food. Some of the stronger species will even grow on rather heavy clay, and, on the other hand, many of the mountain types will persist in a wild state on ledges of rock where there is a very scant supply of earth in which they may take root. Light sand seems to be poorly suited to the needs of the columbine, probably because of the scarcity of plant food in it.

The writer has grown plants on garden loam and clay out-of-doors, and has tried various soil mixtures in flats in the greenhouse. Plants of the same strains of *A. vulgaris* and *A. chrysantha* were planted in the following soil mixtures:

- (a) Sand.
- (b) 1 part each of sand, cinders and compost, with a little stable manure and bone meal added.
- (c) Equal parts of sand and compost, with bone meal and stable manure.
- (d) Compost alone, tending toward a clay type of soil.

Plants were transferred to flats containing these mixtures, when about three inches high. Those in mixture b made a remarkably good growth, and all of the seedlings developed into vigorous plants. Mixture c gave next best re-



sults. Plant in mixture d did fairly well, but a few, growing in poorly drained parts of the flat, died. Those plants which were set in sand made a poor growth, and a number of them died in about a month.

Such tests are not extensive, of course, but they may be safely taken as an indication of the type of soil best suited to the culture of the *Aquilegias*.

Wright (1911), says that columbines grow well in England on a strong loam or clay, but prefer a chalky soil. The plants will make a surprising growth, he says, in comparatively poor soil over limestone. Other English writers (Cf. *The Garden*, Vol. 9) report great success in growing columbines on a thoroughly drained, deep, rich, alluvial loam.

Good drainage appears to be a very important factor in the successful culture of these plants. It prevents a rotting of the plants at times when they are not growing rapidly, and it also reduces the losses from winter-killing, probably because there is less heaving in the lighter soils.

Columbines should be set in a partial shade for best development. They will not tolerate deep shade. On the other hand, they do not seem to be injured by strong sunlight. In choosing the location for columbines, one should keep in mind the conditions under which the plants thrive in the wild state.



### Propagation

The columbines may be propagated either by seeds or by division of the crowns. The former method is much to be preferred, although a division of the plant is sometimes advisable in the case of valuable specimens.

There are two methods of starting columbines. In the first method the seeds are planted in pans or flats during March or April and kept in the greenhouse or in a cold frame until the weather is favorable to outside planting. A light sandy loam is best for this purpose. Care should be taken to keep the seed pans moist during the long period of germination and at the same time to allow enough ventilation to prevent the plants from damping off. The seedlings may be planted at once in a permanent place in the border or rock garden, or they may be set temporarily in a nursery until the colors have been ascertained. If the seeds came from plants of known varieties, the plants may be set in their permanent places at once. Seedlings of mixed lots would better go into a nursery until the nature of their flowers is known. This avoids an unharmonious mixture of colors and shapes in the border.

Seedlings which are set in the nursery should be set in the border the following fall, or, if they have failed to bloom, in the fall of the second year. September is the best month in which to move the plants. This permits the



young plants to develop roots and become well established before cold weather sets in.

By the second method of starting the plants, the seeds are sown as soon as they are ripe. Some writers believe that a better germination is secured in this way. The young plants are transferred to a special bed as soon as the first few seedling leaves appear. They may be set permanently as desired.

The flower stalks should be cut back on all plants which bloom the first year. This relieves the plant of the drain on its vigor incidental to the setting of seed. Plants which set seed the first year frequently die during the winter.

When the plants bloom for the first time they should be staked or labeled in such a way that they can be grouped according to color in the fall.

The triangular system of planting with plants about nine inches apart, is to be recommended for the border.

Where a division of the roots is practiced, the plants should be lifted in September, carefully cut or broken apart, and reset in the border. Plants divided at this time are more likely to bloom the following year than are those which are divided in the spring. In the case of pleasing first-generation hybrids, which will segregate into various types in subsequent generations, the division of the plant affords a means of perpetuating the type. Many plants develop



a root system which is knotty and compact, and these are ill adapted to this method of propagation.

### Biennial and perennial habit

While the columbine is generally considered a perennial and in the wild state probably has the perennial habit, many plants seem to be biennials under cultivation. *A. caerulea*, *A. glandulosa* and *A. vulgaris* seldom flower after the second year, (Horsford) and they should be treated as biennials. In the experience of the writer, *A. caerulea* and *A. chrysantha* have both shown a tendency to disappear during the second winter. Perhaps the rather heavy soil on which they were grown is partly responsible for this.

It must be expected that a certain number of plants will die after the second year and provision should be made for filling their places. Experience will teach the columbine grower which types are most addicted to the biennial habit. It is probably well to sow at least a few seeds of all the types grown, each year, and to sow larger quantities of the plants which behave as biennials. In this way one will have good plants in the fall with which to replace the weakest ones in the border.

Niven (The Garden 9 : 428) says that all species but *A. vulgaris* should be treated as biennials. He speaks of English conditions.



### Forcing

It is sometimes desired to have columbines in bloom in the greenhouse or conservatory during the early spring, or to use them as porch plants in their normal season of flowering. They can be forced without difficulty and the results are well worth any extra trouble.

The seedlings can be potted when large enough and gradually shifted to 5 or 6 inch pots. They should be given a period of rest after frost comes, and they can be brought in for forcing shortly after Christmas. By handling them in this way, the writer has brought plants into bloom by the middle of March.

Plants which are to be used as porch plants should be left in the cold frames until warm weather. When the first flowers appear, the plants may be removed to the porch.

### Pests

The columbine, like nearly every growing thing, has its enemies. Most of them are insects. Fungi are seldom troublesome when the plant is growing well. If the plant "stands still" and suffers from too much moisture, both fungi and bacteria are likely to attack it.\*

There are two rather bad insect pests of the columbine, - the crown-borer and the leaf-miner. The crown-borer

---

\* Mildew sometimes gets on the leaves, but it does not appear to injure the plants seriously.



is the larva of a moth (*Papaipema purpurifascia*. ) It works into the stem of the plant, killing it, and later burrows down into the crown. It also bores into the crowns of younger plants, often either killing them directly or opening the way for bacteria and fungi. The presence of the crown-borer can be detected by the wilting of the affected parts and by the mixture of excrement and borings near the entrance to the burrow. There seems to be no more effective way of getting rid of the borer than to dig it out and destroy it. As it works in the tender crown of the plant, it is impossible to kill it with chemicals without injuring the plant. Perhaps a spray of Bordeaux mixture, or something to act as a repellant, would keep the female moths from laying eggs. The spray would make the foliage unsightly, however, and its use is hardly to be recommended unless the borers are very troublesome.

The leaf miner is a less injurious pest, but it is more likely to attack the plants than the borer. The adult insect is a fly (*Phytomyza aquilegia*, Hardy). It winters over in the pupal stage and appears during the latter part of April and first of May. Eggs are laid about May first. There is a second generation about May 25th, a third the last of June, and a fourth about the middle of September. This last brood winters in the pupal stage.

The eggs are laid in the under sides of the leaves, and the larvae hatch and eat their way through the tissues.



making a serpentine mine which disfigures the leaf and impairs its ability to manufacture starch and other foods. After a while the larvae emerge from crescent-shaped cuts on the under surface of the leaf and form puparia. Parasites play a very important part in keeping the miners under control after the first brood has hatched, but they seem to appear too late to keep the first brood in check.

E. N. Cory gives a good discussion of this pest in *The Journal of Economic Entomology* 9, 1916. He recommends cultivating about the plants after the pupation of the last generation and before April first. This exposes the puparia to frosts and cold and seems to kill many of them. Cory reports a successful control of the leaf-miner in this way.

The writer's plants have been greatly troubled with the leaf-miner in the greenhouse. At first it was thought that fumigation would keep the insects under control, but neither hydrogen-cyanide or nicofume seemed to kill the larvae in the mines. A spray of one ounce of "black-leaf 40" to 6 gallons of water also failed to keep them in check. Finally an attempt was made to keep all of the infested parts picked off. This took a great deal of time and it reduced some plants very much in size. It was not a completely effective method of control.

Where columbines are raised in the greenhouses, the



red spider and white fly are likely to prove troublesome. The former can be controlled by syringing and the latter by fumigation.

### Natural Crossing

It is well known by gardeners that columbines which are allowed to seed themselves quickly "degenerate." Undesirable forms soon appear and the original types often are lost. This is due to a natural crossing of the plants by insects, and the undesirable types are ill-chosen hybrids.

The columbine flower is well adapted to crossing by insects. It is conspicuous and the parts are exposed. The bee is unable to bend its proboscis upward; according to Muller (1883), so it has to take such a position on the flower that it can probe into the curving spurs. This position generally brings the bee's hind legs and body in contact with the stamens and pistils. A cross-pollination is bound to occur.

Many bees, more particularly the honey bees, have not probosces long enough to reach to the bottom of the spurs for the nectar. In some way these bees have learned to bite through the spurs near the base to get the nectar. Often the flowers are rather badly disfigured in this way.

In order to see how much crossing was going on in nature, several seed-pods were selected at random from plants growing at the New York Botanic Garden. There were about



twenty different kinds of *Aquilegias* growing in the vicinity so any effects of crossing would be likely to appear in the hybrid progeny. One capsule showed no effects of crossing. The flower which produced it had evidently been self-fertilized. The other two capsules selected gave a number of very dissimilar hybrid types. In one case there were seventeen distinct types to be found among thirty-five plants. The seed parents were type species in each case and not hybrid plants. In this instance it is evident that the male parent or parents were hybrid.

Humming birds probe into the spurs of the columbines many times a day. They frequently work about within arm's reach as one hybridizes the plants. Pollen can be distinctly seen on the bills and breasts of these birds. They probably effect many crosses.

Self-fertilization may easily take place in the columbine because of the position of the flower parts. In fact, there is evidence that it frequently does take place. It is probably the exception, however, rather than the rule.

If one desires self-fertilized seed, it is necessary to bag the flowers before they have opened. The transparent glazine bags are best for this purpose. There is no evidence that "selfing" tends to reduce the vigor of the strain. *A. chrysantha* and *A. vulgaris* were selfed for three generations in these studies and no ill effects were apparent. Other



species were selfed for two generations with no ill effects.

### The Garden Columbines

One would imagine from the seed catalogues that there are many varieties of columbines in the horticultural trade, and that it is not difficult to get a pure strain of any variety listed. Such is far from the case. The seedsman's list of varieties is generally more complete than his collection of seed. Often the seed has been produced from open-fertilized flowers. The result is that one cannot order seeds of any given species and be sure that they will be pure. In the experience of the writer many packages of seed have proved to be worthless mixtures, often with undesirable hybrid types predominating. Of about 30 plants which were purchased from a large seed house, fewer than 12 were true to name. The company endeavored to replace the misnamed sorts, but with less success than in the first shipment. None were named correctly.

The more common species of columbines can usually be obtained from the seedsmen, and by repeated trials one can probably get some of the rarer sorts. Once plants of a desirable type have been obtained, they should be propagated by self-fertilized seed. Anyone who aims to have a good collection of *Aquilegias* should keep pure strains of the more important species growing. Many of the species types are more pleasing than their hybrids and they should be given a



place in the garden.

In 1914 a survey was made of the seed catalogues in order to determine which varieties were offered for sale most widely. The results of such a tabulation ought to show which species are most popular in the garden. The summary of results is given in the following table:

| Species        | Bot. var. | Hort. Var.       | Catalogues listing |
|----------------|-----------|------------------|--------------------|
| Chrysantha     |           |                  | 23                 |
| Caerulea       |           |                  | 22                 |
| Canadensis     |           |                  | 16                 |
| -----          |           | Double mixed     | 14                 |
| -----          |           | Single "         | 13                 |
| California     |           | hybrida          | 12                 |
| Skinneri       |           |                  | 12                 |
| Vulgaris       | Nivea     | grandiflora alba | 11                 |
| Chrysantha     |           | " "              | 11                 |
| -----          |           | special hybrids  | 10                 |
| Caerulea       |           | hybrida          | 7                  |
| "              |           | " (Rose Queen)   | 6                  |
| Glandulosa     |           |                  | 6                  |
| Vulgaris       |           |                  | 6                  |
| "              |           | flore pleno      | 6                  |
| Truncata       |           |                  | 5                  |
| Stuarti        |           |                  | 5                  |
| Helenae        |           |                  | 4                  |
| Alpina         |           |                  | 4                  |
| Flabellata     |           | nana-alba        | 4                  |
| Jaetskani      |           |                  | 3                  |
| Vulgaris       | Nivea     |                  | 3                  |
| Chrysantha     |           | flore pleno      | 2                  |
| Haylodgensis - | Hort. -   |                  | 2                  |
| Olympica       |           |                  | 2                  |
| Caerulea       |           | alba             | 2                  |
| Haylodgensis   |           | delicatissima    | 2                  |
| Vervaeana      |           |                  | 1                  |
| Baicalensis    |           |                  | 1                  |
| Oxysepala      |           |                  | 1                  |
| Flabellata     |           |                  | 1                  |
| Sibirica       |           |                  | 1                  |

1913-1914 - Forms listed - 33

Catalogues surveyed - 28



Mabel Cabot Sedgwick (p. 491) recommends the following sorts for cultivation in the garden:

Alpina  
 Caerulea  
 Glandulosa  
 Stuarti  
 Oxysepala  
 Vulgaris  
     "      vervaeneana  
     "      alba  
     "      flore pleno  
 Canadensis  
     "      flaviflora  
 Truncata  
 Flabellata  
     "      nana-alba  
 Formosa hybrida  
 Skinneri  
 Chrysantha



### Hybrid Columbines

Some of the prettiest forms of garden columbines are hybrids. The long-spurred hybrids of *A. caerulea* crossed with other species are among the best. *A. caerulea* by *A. chrysantha* gives beautiful, long-spurred flowers of a delicate lavender and yellow. The writer has made this cross several times and obtained very pretty first generation types in each case. *A. Skinneri* is said to give excellent results in hybridization. *A. chrysantha*, also, hybridizes well with certain other species.

First generation hybrids are often very useful and it is frequently unnecessary to carry the plants into a second generation to secure beautiful types. It must be remembered, however, that a much greater variety of types is obtained in the second generation. These segregates contain recombinations of genetic factors and are frequently quite diverse in form and color. Certain of the new forms are very unlike either parent. Some of these are valuable and others worthless. It would be well to raise second generation hybrids in a nursery, in order that they may be sorted according to colors before being transplanted to a permanent position.

It must be remembered that not all hybrids are desirable. Many are quite displeasing in color. It is not enough to raise hybrids, merely. One should raise hybrids from known varieties which have given good results in previ-



ous crosses. For this purpose it is well to have growing a number of pure strains of the best types of columbines.

The crosses are easy to make. The flower should be emasculated before the sepals unfold, thus avoiding any chance of natural cross-pollination. The sepals can be separated easily by means of forceps and the stamens pulled out with the same instruments. Great care must be taken to remove all the stamens, lest one be left in to burst and contaminate the cross. Often an anther sac will fall into a spur unnoticed. There is a chance that it would mature and perhaps be able to scatter pollen upon the stigmas if the flowers were inverted by the weight of the bag. For most accurate work it is well to remove the spurs as well as the stamens. Such treatment does not seem to impair the setting of seed.

After emasculation the bud should be bagged carefully and left until the stigmas are receptive. The flowers are usually ready for pollination two days after emasculation, though the time may be longer than this when the crosses are made indoors. After pollination the flowers should be rebagged until fertilization has taken place. When the styles have withered and the ovary begins to enlarge, the bags may be removed without danger of contamination. Each successful cross will yield from a few to one hundred and fifty seeds or even more.



*Aquilegia* is a genus within which it is possible to make many species crosses. A number of crosses have been made incidental to these studies and in some cases the hybrids have been carried to the second generation. The work has not progressed far enough, however, to constitute a good genetic analysis of the species used. The report on these hybrids will be reserved until a later time.

The following species crosses have been successfully made:

- A. flabellata* x *A. vulgaris* var. *nivea*
- A. vulgaris* x *A. baikalensis*
- A. flabellata* x *A. baikalensis*
- A. formosa* var. *hybrida* x *A. chrysantha*
- A. vulgaris* flore pleno x *A. chrysantha*
- \**A. chrysantha* x *A. alpina* var. *superba*
- A. canadensis* x *A. vulgaris* var. *stellata*
- A.* " x *A.* "
- A.* " x *A. caerulea*
- A. canadensis* x *A. chrysantha*
- A.* " x *A. vulgaris* var. *nivea*
- A. vulgaris* var. *stellata* x *A. chrysantha*
- A. caerulea* x *A. chrysantha*
- A.* " x *A. vulgaris*
- A. vulgaris* x *A. chrysantha*

---

\*35 F<sub>1</sub> plants all sterile

In many cases reciprocal crosses were made.



### Double flowers

There are two types of double columbines: the short-spurred doubles and long-spurred doubles.

The short spurred doubles show an increase in the number of whorls of the corolla and calyx. The sepals are usually increased to ten in number, instead of five, by the appearance of a second whorl whose parts alternate with those of the first. Similarly another whorl of petals gives the simplest type of doubling, the ten-spurred condition. While the second whorl of parts is slightly above the first, it is close enough to it to appear part of the first whorl. Each succeeding whorl of petals is added at the expense of a whorl of stamens. Its parts are, therefore, alternate with those of the preceding and succeeding whorls, and opposite to those of the second whorl from it. (See diagram 1). The spurs of the third whorl fit inside those of the first whorl in what is spoken of as a hose-in-hose manner. With three whorls of petals the vertical tiers would show the following arrangement of spurs: 1 + 2 + 1 + 2 + 1 + 2, etc. (See plate 13). With four whorls the vertical tiers would be: 2 + 2 + 2 + 2, etc. With five tiers the spurs would alternate in this way: 2 + 3 + 2 + 3, etc. So with four whorls of spurs the flower would have ten sets of 2-tier spurs. With six whorls there would be ten sets of 3-tier spurs; with eight whorls, ten sets of 4-tier spurs; and with ten whorls, ten sets of 5-tier spurs.





Plate 13 - *A. vulgaris* var. *flore pleno*,  
showing the 1 + 2 + 1 + 2 type of doubling.



So! ! the very double forms of *A. vulgaris* var. *flore pleno* are on the last sort. (See plate 9, plant 211). In some of the extremely double types there has been such an increase in the number of petal-whorls that the stamens are almost entirely lacking. It is usually possible, however, to find enough pollen to self-fertilize the blossoms and produce a few seeds.

In the case of the long-spurred doubles, the manner of doubling is the same as that described above, but the effect is different. Instead of a hose-in-hose doubling throughout the flower, only occasional hose-in-hose flowers are found. The tips of the spurs of the upper whorls get caught on the parts below and the spurs become greatly bent and twisted. The flower appears mis-shapen and irregular. For this reason the long-spurred doubles are not desirable for the border.





Plate 14 - Floral abnormality in *A. caerulea*, James. Flower developing in center of seed capsule.



# BIBLIOGRAPHY

- Albee, Helen R. - Hardy plants for cottage gardens. N. Y.  
(Henry Holt & Co.) 1910
- Baker, J. G. - A synopsis of *Aquilegia*.  
Gard. Chron. 2nd Ser. 10 : pp 19, 76, 111 and 203. 1878.
- Baur, E. - untersuchungen uber die Vererbung von chromatophor-  
merkmalen bei *Melandrium*, *Antirrhinum* and *Aquilegia*.  
Zeitschr fur ind. Abst. u. Vererb 4, 1910-11: 81-102.
- Bentham, Geo. - Handbook of British flora. London.  
(Lovell, Reeve & Co.) 1865 - 2 vols.
- Britton, N. L. - Illustrated flora of the northern states and  
Canada - Vol. 2, p. 92.
- Brown, S. - Alpine flora of the Canadian Rocky Mountains. 1907.  
pp. 105-107.
- Chapman, A. W. - Flora of the southern United States. 1865.  
p. 9.
- Cockerell, T. D. A. - A new hybrid columbine. Bot. Gaz. 62,  
413-414. 1916.
- Cory, E. N. - The columbine leaf-miner.  
Journ. Ec. Ent. 9. 1916 - 419-424.
- Coulter, J. M. - Botany of western Texas.  
U. S. Herb. Cont. 2. 1891-94 : 9.
- Coulter, J. M. and Nelson A. - A new manual of botany of  
the central Rocky Mountains. N. Y. (Am. Book Co.) 1909.  
p. 646.
- Coville, F. V. - Botany of the Death Valley expedition,  
U. S. Nat. Herb. Cont. 4. 1893. 56, 264, 267, 273.
- Coville, F. V. - Botany of the Yakutat Bay, Alaska.  
U. S. Nat. Herb. Cont. 3. 1895 : p. 336.
- Darby, John - Botany of the southern states, N. Y. 1856 : 206.
- Davis, K. C. and Horsford, F. H. - *Aquilegia* - In Bailey's  
Cyc. Hort. N. Y. (Macmillan Co. ) 1900. Vol. 1: 84-86



- Dodoens, R.- A new herbal, or historie of plants. London.  
1619 : 119.
- Eaton, A., and Wright, J. - North American botany.  
Troy, N. Y. 1840 : 66, 130.
- Egan, Wm. C. - Making a garden of perennials. N. Y.  
(McBride, Nast & Co.) 1912.
- Fuchs, Leonardo -De Historia stirpium, etc. 1542. pp. 101-103.
- Gerarde, John - The herball, or generall historie of plantes.  
London, 1633: pp. 1092-1095.
- Goebel, K. - Outlines of classification and special morphology  
of plants. Oxford - 1887.
- Gray, Asa - Genera of the plants of the United States. N. Y.  
(Putnam). 1849. Vol. 1 : 39-40.
- Gray, A. - Synoptic flora of North America.  
Vol. 1 - 42-45.
- Hall, H. M., and Hall, H. C., - A Yosemite flora - SanFran-  
cisco (Elder & Co.) 1912. p. 98.
- Henshaw, Mrs. Julia W. - Mountain wild flowers of America.  
Boston (Ginn & Co.). 1906 - 135, 191, 262.
- Henshaw, Mrs. Julia W. - Wild Flowers of the North American  
Mountains. N. Y. (R. M. McBride & Co.) 1915. pp. 213,  
261, 317.
- Hooker, W. J. and Jackson - Index Kewensis.  
Also supplements of same.
- Hooker, Wm. J. - Flora Boreali Americana. Vol. 1. London.  
(H. P. Bohn) 1840. pp. 24-25.
- King, Mrs. Francis - The well-considered garden. N. Y.  
(Scribners) 1915. pp. 27, 32, 45, 108-141, 248-250.
- Linnaeus, C. - Species plantarum.  
1762. Vol. 1, p. 752.
- Linnaeus, C. - Systema naturae. Vol. 2. 1766-68. p. 70.
- Lounsberry, Alice, - Gardens near the Sea.  
N. Y. (F. A. Stokes Co.) 1910 : 174, 249.



- Lubbock, Sir John - On British wild flowers considered in relation to insects. London (Macmillan) 1875. pp. 20,40.
- McFarland, J. H. - My growing garden. N. Y. (Macmillan) 1915. p. 181.
- Meehan, Thos. - The native flowers and ferns of the United States. Boston (L. Prang & Co.) 1878. Vol. 1 : 25-28.
- Miller, Philip - The gardeners' and botanists' dictionary. London. 1807.
- Mohr, Chas. - Plant life of Alabama.  
U. S. Nat. Herb. Cont. 1901. 6 : 509.
- Muller, H. - The fertilization of flowers.  
London, (Macmillan), 1883 : 81-82.
- Nuttall, Thos. - Genera of North American plants and a catalogue of the species to the year 1817. Phil. 1818 : p. 15.
- Parry, C. C. - *Aquilegia caerulea*. Amer. Nat. 8. 1874.
- Piper, C. V. - Flora of the state of Washington.  
U. S. Nat. Herb. Cont. 11. 1906. pp. 58, 278.
- Pursh, Frederick - *Flora Americae septentrionalis*. London. 1814.
- Ramaley, F. - Wild Flowers and trees of Colorado. 1909. p. 22.
- Robinson, W. - Alpine flowers for English gardens.  
London. (John Murray) - 1870 - pp. 146-148
- Rose, J. N. - Studies of Mexican and Central American plants.  
U. S. Nat. Herb. Cont. 12 : 1909. p. 265.
- Rydberg, P. A. - Flora of the Black Hills of South Dakota.  
U. S. Nat. Herb. 3. 1896 : 480-482.
- Rydberg, P. A. - Flora of Colorado. Cal. Exp. Sta. Bul. 100. 1905. pp. 136-137.
- Saunders, Miss E. R. - Double flowers. Roy. Hort. Soc. Journ. 38. 1912-13 : 469-482.
- Sedgwick, Mabel C. - The garden month by month. N. Y. (F. A. Stokes Co.) 1907. pp. 142-143



- Standley, P. C. - The type localities of plants first described from New Mexico. U. S. Nat. Herb. Cont. 13. 1900. pp. 164 + 185.
- Thomas, H. H. - The book of hardy flowers. N. Y. (Funk). 1915. pp. 37-58.
- Torrey, J. and Gray, A. - Collections made by Capt. Gunnison, topographical engineer----etc. 1854.
- Tournefort, Joseph P. - Institutiones rei herbariae. Paris. 1719 - Tab. 242.
- Watson, S. - U. S. Geographical exploration of the 40th parallel. Vol. 5 - 1871. p. 525.
- Wiegand, K. C. - A synopsis of the plant kingdom. In Bailey's Cyc. Hort. Vol. 1.
- Woolton, H. O. and Standley, P. C. - Flora of New Mexico. U. S. Nat. Herb. Cont. 19. 1915. pp. 248-249.
- Wright, W. P. - Popular garden flowers. N. Y. (Doubleday) 1911.
- Wright, W. P. - Alpine flowers and rock gardens. London. (Headley Bros.) 1913. pp. 130-133.
- Anon. - Aquilegias and their hybrids. Am. Florist, May 23, 1914.
- Anon. - Aquilegias at Wisley. Roy. Hort. Soc. Journ. Vol. 40, pt. 2, pp. 272-275. 1914.
- 
- Gardeners' Monthly - various short articles as follows: Vol. 23, p. 200; Vol. 24, p. 228; Vol. 24, p. 248; Vol. 25, p. 278; Vol. 7, p. 120; Vol. 9, p. 181; Vol. 15, p. 344, p. 278; Vol. 19, p. 100, p. 37; and Vol. 21, p. 227.
- 
- The Garden (London). Various short articles as follows: Vol. 1, pp. 574, 568; Vol. 3, pp. 390, 430, 464; Vol. 4, p. 460; Vol. 9, pp. 385, 384, 563, 428; Vol. 13, pp. 542, 537, 594, 567, 568, 387, 455, 459, 516; Vol. 14, pp. 1-2, 563; Vol. 16, pp. 264, 285; Vol. 17, pp. 173, 514, 312, 193, 76, 149; Vol. 19, pp. 591, 597, 646; Vol. 20, pp. 287, 312.









